JIIT NOIDA

Course Descriptions of B. Sc. in Computer Science program for 2024-2028 and 2025-29 batches

First Semester

Introduction to Programming Using C (22B21MA111)

Introduction to Programming Using C will cover Introduction, Data types, Operators, and Control Flow, Array, Functions, Structures and Union, Pointers and File Handling.

Course Description

Course Code	**22B21MA111**	**Semester: Odd**	**Semester I Session 2023-24 Month from Jul 2023 to Dec 2023**		
Course Name	**Introduction to Programming Using C**				
Credits	**3**	**Contact Hours**	**3-0-0**		
	Coordinator(s)				
	Teacher(s) (Alphabetically)				
COURSE OUTCOMES: After the successful completion of this course, the student will be able to					**COGNITIVE LEVELS**
K101.1	explain various data types, memory allocation schemes, precedence of arithmetical and logical operations, and need of array, and structures				Understanding (C2)
K101.2	explain the flow chart and write the high-level code for different problems				Understanding (C2)
K101.3	apply and implement functions with or without pointers for different problems				Applying (C3)
K101.4	apply and implement various operations like traverse, insertion, deletion, etc. on files				Applying (C3)
Module No.	**Title of the Module**	**Topics in the Module**			**No. of Lectures**
1.	Introduction	Introduction to Logic building, Step by step solution to simple problems, developing logic/flow- chart/pseudo code to solve problems like simple/logical games, puzzles.			9
2.	Data types, Operators, and Control Flow	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, operations using different operators, if, if-else, while, do-while, for, switch-case in C Programming			9

3.	Array	Fundamentals of Array, Implementation of 1D/2D Array and related operations like insertion, traversal, updation, etc. in C programming using different problems	6
4.	Functions	Introduction to Functions and its implementation in C programming language, Functions using Pass by value, recursive functions	4
5.	Structures and Union	Introduction and implementation of Structures and Union in C programming, Array of Structures and related operations like insertion, traversal, updation, etc. in C programming using different problems, Function using structures	4
6.	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference	6
7.	File Handling	Introduction to File, creation of files in C programming language, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file.	4
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments,PBL)
Total	**100**

Project based learning: Each student in a group of 4-5 will apply the concepts of C programming to solve practical problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

Text Books	
1	H. Schildt. "The Complete Reference C", 4th Edition, TMH, 2000
2	A. N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, Delhi, 2006
3	H. Cooper, H. Mullish, "Spirit of C", 4th Edition, Jaico Publishing House, 2006
4	G. Perry, D. Miller, "C Programming Absolute Beginner's Guide Paperback", QUE; 3rd edition, 2013
5	Y. Kanetkar, "Let Us C: Authentic Guide to C Programming Language" 17th edition, BPB publisher, 2020.
Reference Books	
1	D. Griffiths, D. Griffiths, "Head First C: A Brain-Friendly Guide", O'Reilly Media, Inc., 2012.

2	B. W. Kernighan, D. M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall India, New Delhi, 2002
3	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Thomson Press, New Delhi, 2006

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K101.1	3	2	1	1	1		2	1	2	3
K101.2	3	2	2	3	1		3	1	2	3
K101.3	3	2	2	2	1		2	1	2	2
K101.4	3	2	2	2	1		3	1	2	3
Avg	**3.00**	**2.00**	**1.75**	**2.00**	**1.00**		**2.50**	**1.00**	**2.00**	**2.75**

Introduction to Programming Using C LAB (22B25MA111)

Course Description

Course Code	**22B25MA111**	**Semester: Odd**	**Semester I Session 2024-25 Month from Jul 2024 to Dec 2024**
Course Name	**Introduction to Programming Using C LAB**		
Credits	**2**	**Contact Hours**	0-0-4
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K131.1	explain data types, expressions and conditional statements using programming syntax.	Understanding (C2)
K131.2	develop programs for arrays, functions, structure and union.	Applying (C3)
K131.3	develop programs for recursive functions and pointers.	Applying (C3)
K131.4	examine file operations using programming skills.	Analyzing (C4)

Module No.	**Title of the Module**	**List of Experiments**	**No of Labs**
1.	Introduction	Introduction to Logic building, Step by step solution to simple problems, developing logic/flow-chart/pseudocode to solve problems like simple/logical games, puzzles. Introduction to Code block (Editor for C)	4
2.	Data types, Operators,	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, operations	4

	and Control Flow	using different operators, if, if-else, while, do-while, for, switch-case in C Programming	
3.	Array	Fundamentals of Array, Implementation of 1D/2D Array and related operations like insertion, traversal, updation, etc. in C programming using different problems.	4
4.	Functions	Introduction to Functions and its implementation in C programming language, Functions using Pass by value, recursive functions	4
5.	Structures and Union	Introduction and implementation of Structures and Union in C programming, Array of Structures and related operations like insertion, traversal, updation, etc. in C programming using different problems, Structures using function	4
6.	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference	4
7.	File Handling	Introduction to File, creation of files in C programming language, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file.	4
		Total No. of Labs	**28**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test -1	20
Lab Test -2	20
Day to Day	60
(Evaluation 1- 15, Evaluation 2- 15, Mini Project- 15, Attendance- 15)	
Total	**100**

Project based learning: Each student in a group of 3-4 will develop a mini project with the help of various concepts of C programming. In a team they will learn how to apply the concepts for problem solving in a meaningful way.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

Text Books

1	H. Schildt. "The Complete Reference C", 4th Edition, TMH, 2000
2	A. N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, Delhi, 2006
3	H. Cooper, H. Mullish, "Spirit of C", 4th Edition, Jaico Publishing House, 2006
4	G. Perry, D. Miller, "C Programming Absolute Beginner's Guide Paperback", QUE; 3rd edition, 2013
5	Y. Kanetkar, "Let Us C: Authentic Guide to C Programming Language" 17th edition, BPB publisher, 2020.

Reference Books

1	D. Griffiths, D. Griffiths, "Head First C: A Brain-Friendly Guide", O'Reilly Media, Inc., 2012.
2	B. W. Kernighan, D. M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall India, New Delhi, 2002

3	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Thomson Press, New Delhi, 2006

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K131.1	3	1	1	1	1		2	1	2	3
K131.2	3	2	2	2	1		2	1	2	3
K131.3	3	2	2	2	1		3	1	2	3
K131.4	3	2	3	2	1		3	1	2	3
Avg	**3.00**	**1.75**	**2.00**	**1.75**	**1.00**		**2.50**	**1.00**	**2.00**	**3.00**

Discrete Mathematical Structures (22B21MA113)

Course Description

Course Code	**22B21MA113**	**Semester Odd**	**Semester I Session 2024-25 Month from Jul 2024 to Dec 2024**
Course Name	**Discrete Mathematical Structures**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K121.1	recall the basics of set theory, functions and relations.	Remembering (C1)
K121.2	explain Hasse diagram, lattices, generating function, propositional calculus, algebraic structure and graphs.	Understanding (C2)
K121.3	solve the problems related to lattices, recurrence relations, propositional calculus, graph theory and algebraic structures.	Applying (C3)
K121.4	analyse different graph theoretic algorithms for solving related problems.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	Set theory and Relations	Basic concept of set theory, operations on sets, Venn diagram, relations and their composition, pictorial representation, matrix and graphical representations, equivalence relations and partitions, closure of relation, Warshall's algorithm for transitive closure, partial ordered relations and POSET, Hasse diagram, Isomorphism of partial order relation	10
2.	Lattices, Boolean Algebra and Numeric Functions	Different types of lattices, isomorphic lattices, Boolean algebra, discrete numeric functions, asymptotic behavior of numeric functions, generating functions, solution of recurrence relations by generating function, recursive functions, homogenous and particular solution of recurrence relations of constant coefficients.	12

3.	Predicate and Propositional Calculus	Propositions- simple and compound, basic logical operators and their truth tables, tautologies and contradictions, validity of arguments. Normal forms: disjunctive and conjunctive normal forms, Predicates and quantifiers, logical equivalence.	7
4.	Graphs	Graphs and related definitions, subgraphs, isomorphism, paths and connectivity, Eulerian graph and Konigsberg problem, Hamiltonian graph, minimum spanning tree (Prim's algorithm), graph colorings, digraphs, adjacency matrix, incidence matrix, path matrix	9
5.	Algebraic Structures	Groups- definitions and examples, order of elements, subgroup, cyclic group, rings and fields.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to the diversified applications of graph theory. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

1.	S. Lipschutz, M.L. Lipson, and V.H. Patil, Discrete Mathematics, Revised 3rd Edition, McGraw-Hill Education, 2017.
2.	K.H. Rosen, Discrete Mathematics and its Application, 7th Edition, Tata McGraw-Hill, 2011.
3.	C. L. Liu, D. Mahapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, 4th Edition, McGraw-Hill, 2017.
4.	B. Kolman, R.C. Busby, and S. Ross, Discrete Mathematical Structures, 6th Edition, Pearson Education India, 2015.
5.	N. Deo, Graph Theory, Prentice Hall of India, 1980.
6.	R.P. Grimaldi, Discrete and Combinatorial Mathematics, 4th Edition, Pearson Education, 2005.

CO-PO-PSO Mapping:

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K121.1	2	1	1	1	1		1	2	2	1
K121.2	2	2	2	1	1		1	1	2	2
K121.3	2	3	2	1	1		1	1	2	2
K121.4	3	3	3	2	1		2	1	2	2
Avg	**2.25**	**2.25**	**2.00**	**1.25**	**1.00**		**1.25**	**1.25**	**2.00**	**1.75**

Optics and Electromagnetism (23B21PH111)

Interference, Diffraction and Polarization of Light, Gauss's Law and applications, Laplace and Poisson's Equations, Maxwell's Equations, Electromagnetic Waves, Poynting's theorem and Poynting vector, Propagation of Electromagnetic waves in Free Space, Transverse nature of EM waves, Energy and momentum in EM waves, Lasers, Principles and working of lasers, three level Laser Scheme, Ruby laser, Applications of lasers Optical Fiber, working principle, applications of fiber.

Course Description

Course Code	**23B21PH111**	**Semester Odd**	**Semester I Session 2023-24 Month from Jul 2023 to Dec 2023**
Course Name	**Optics and Electromagnetism**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K142.1	recall the basic principles of physics related to optics, electromagnetic theory, laser and fiber optics.	Remembering (C1)
K142.2	illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.	Understanding (C2)
K142.3	apply the concepts/principles to solve the problems related to wave nature of light, electromagnetic theory, laser and optical fiber.	Applying (C3)
K142.4	analyze and examine the solution of the problems using physical and mathematical concepts involved.	Analyzing(C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Physical Optics	Interference: Introduction to wave nature, analytical treatment of interference, Intensity distribution of fringe system, Fresnel's Bi-prism, interference by thin films, Newton's rings. Diffraction: Introduction, Diffraction (limited to Fraunhofer class) from Single slit, double slit and Diffraction grating. Polarization: Introduction to polarization, Brewster's law, Malus law, Birefringence, Principles of use of uni-axial crystals in practical polarizers, compensators and wave plates, Optical activity.	17
2.	Electromagnetic Theory	Introduction of electromagnetism, Basic idea of Cartesian, Spherical polar and cylindrical coordinate systems, Basics of fields, Gradient, Divergence and Curl, Coulomb's law, Electric Flux & Gauss's law, Applications of Gauss law for Spherical and Cylindrical symmetries (all important cases), conductors, Force per unit area on the surface of the charged conductor, Laplace and Poisson's equations, Maxwell's correction to Ampere's law, Displacement current, Maxwell's equations in free space and dielectric media, Poynting's theorem (derivation) and Poynting vector, Electromagnetic waves in free space	15

		(equations and solutions) and Transverse nature of EM waves, Energy and momentum in EM waves.	
3.	Lasers	Introduction to Laser, spontaneous and stimulated emission, population inversion, Einstein A and B coefficients, Principles and working of lasers, Three level Laser Scheme, Ruby laser, Applications of lasers	4
4.	Optical Fiber	Concept of optical fiber and Principle of Total Internal Reflection in optical fiber, Numerical aperture and Single, multistep & graded index fiber, Attenuation coefficient, Transmission losses in optical fiber, Applications of an optical fiber.	4
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: The students will be given small projects (in groups) on various topics like Interference, diffraction, polarization, electromagnetism, laser and optical fiber to explore their applications in advanced technology to understand the role of physics. This will help the students to connect the concept studied in the class with their application in technology and will enhance their analytical skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

1.	A. K. Ghatak, *Optics*, Tata McGraw Hill.
2.	E. Hecht, *Optics*, Pearson Education.
3.	F. A. Jenkins, H. E. White, *Fundamentals of optics*, Tata McGraw Hill.
4.	D. J. Griffiths, Introduction to Electrodynamics, Prentice-Hall India.
5.	G. Keiser, Optical Fiber Communications, Tata Mc Graw Hill Education.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K142.1		1		1					2	
K142.2		1		1					2	
K142.3		2		1					1	
K142.4		2		1					1	
Avg		**1.50**		**1.00**					**1.50**	

ENGLISH (22B28HS111)

Course Description

Course Code	**22B28HS111**	**Semester Odd**	**Semester I Session 2024-25**

			Month from Jul 2024 to Dec 2024	
Course Name	**English**			
Credits	**2**	**Contact Hours**	**1-0-2**	
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K151.1	explain the basic aspects of English as a communication tool.	Understanding (C2)
K151.2	apply the concepts of grammar, vocabulary skills, and Phonetics in presentation, spoken, written communications and pronunciation.	Applying (C3)
K151.3	develop different forms of professional writing.	Applying (C3)
K151.4	analyze the different literary and rhetorical devices used in discourse.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	English as a Communication Tool	Communication, Basic aspects of English: LSRW: Listening/ Speaking, Reading/ Writing, Non-Verbal Communication, Presentation Techniques and Gambits for Interviews	6
2.	Language and Literary devices	Phonetics: Pronunciation, Stress, Rhythm, Intonation, Literary and Rhetorical Devices	2
3.	Professional Application/Writing	Letter Writing, Email Etiquettes, Review Writing, Notice, Agenda and Minutes, Format of Report Writing, CV and Resume	3
4.	Grammar & Vocabulary	Parts of Speech and Agreement of Noun-Verb, Tense, Aspect, Mood and Voice, Vocabulary Enrichment techniques, Synonyms, Antonyms, Homonyms, Homophones, Collocation	3
		Total number of Lectures	**14**

English LAB

Module No.	**Title of the Module**	**List of Experiments**	**No. of Lectures**
1	Interpersonal Oral Communication through self-Introduction	Interpersonal Communication; Learning the Impact of Perception on Interpersonal Communication	2
2	Confident Non-Verbal Behaviour	To be able to impart good body language and learn aspects of non-verbal behaviour	2
3	Basics of Formal Presentations	PPT Presentation; Reading Newspapers, comprehending and presenting in own words with confidence & assertiveness	2
4	Listening through Language Lab Software (SKY IELTS)	Active Listening; Academic Listening; Listening to Debates and Presentations; Note-taking Techniques; comprehending through lab software	2
5	Phonetics and Pronunciation	Phonetics; Speaking	2

	through lab (SKY Pronounce)		
6	Reading Practice & Comprehension through SKY Read Up Speed Up Software	Purpose, Process, Methodologies; Skimming and Scanning; Levels of Reading; Reading Comprehension; Academic Reading Tips	2
7	Grammar for Professional Writing Requirements: Parts of Speech; Tense, Voice, Types of Sentences; Vocabulary Enhancement	Passage Comprehension; Jumbled Paragraphs for grammar learning; Summary/Inference of short paragraph; Picking the Out of Context sentence in a Jumbled Paragraph; Email Writing etiquettes; Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence,Writing introduction and conclusion	2
		Total No. of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, PBL)
Total	**100**

PBL Component: The creative writing project is to be done in a group of 3-4 students. Students will be asked to choose one specific word that impacts all six dimensions of their life-mental, physical, emotional, relational, spiritual and financial and create a project based on that.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)

1.	C.L. Bovee, J.V.Thill, and M.Chaturvedi, *Business Communication Today*,9th Ed, Pearson Education, copyright@ Dorling Kinderslay (India) Pvt Ltd,2009
2.	K. M. Quintanilla and S.T.Wahl, *Business and Professional Communication*, Sage Publications Pvt India Ltd,2011
3.	S. Kumar, P. Lata, *Communication Skills*, Oxford University Press,1st, Ed. 2011
4.	R.K Bansal, J.B Harrison, *Spoken English for India*, Orient Longman, 2018
5.	M A Yadugiri, The Pronunciation of English: Principles and Practice, Viva Books Pvt. Ltd, India, 2015
6.	A. R. Rizvi, Effective Technical Communication, 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018.
7.	R. Murphy, English Grammar in Use, 4th edition, Cambridge University Press, 2012.
8.	M. Hewings, *English Pronunciation in Use*. Advanced. Cambridge: CUP, 2009
9.	K. Mohan, N. P. Singh, *Speaking English Effectively* 2nd Edition. Macmillan Publishers India Ltd. Delhi. 2011
10.	E. S. Kumar, P. Sreehari, *A Handbook for English Language Laboratories*. New Delhi: Foundation, 2009.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K151.1								3	2	
K151.2							1	3	2	
K151.3							1	3		
K151.4								3	2	
Avg							**1.00**	**3.00**	**2.00**	

Life Skills and Effective Communication (22B12HS111)

Course Description

Course Code	**22B12HS111**	**Semester: Odd**	**Semester I Session 2024-25 Month from July 2024 –Dec 2024**
Course Name	**Life Skills and Effective Communication**		
Credits	**3**	**Contact Hours**	2-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K161.1	explain different life skills and concepts of effective communication.	Understanding (C2)
K161.2	apply life skills and concepts of effective communication in personal and professional environments.	Applying (C3)
K161.3	examine strategies for enhancing life skills and communication for personal and professional excellence.	Analyzing (C4)
K161.4	develop solutions for enhancing life skills and communication.	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction**	Overview of Life Skills: Meaning and significance of life skills, Life skills identified by various organizations, Life Skills for Self, Family, Society and lifelong success.	3
2.	**Advanced LSRW Skills**	Advanced Reading and Comprehension Skills, inferring lexical and contextual meaning, employing discourse analysis, Advanced Speaking Skills: Conversations, Dialogues and Debates, Persuasion, Negotiation Skills, Expressing Opinions, Agreement and Disagreement, Advanced Listening Skills, Advanced Writing skills: The art of Condensation, Note making, Essay Writing.	5
3.	**Work-Place Skills**	Interpersonal Skills: Team- work skills, Empathy, Emotional Intelligence, VUCA Leadership,	3

		Resilience, Tolerance, Self-Belief and Time Management	
		Presentation and Interaction Skills: Speech Delivery, Group Discussion, Presentation Skills (Focused and targeted information seeking and presentation), Public Speaking, Audience Analysis, Interviews, Assessment of Personality - Projective& Self Report Techniques - Building Self-Confidence – Enhancing Personality Skills.	4
		Creativity and Critical Thinking: Creativity: Definition; Characteristics of Creative Person: Fluency; Originality; Curiosity; Critical Thinking, Problem Solving Techniques: Six Thinking Hats, Mind Mapping etc.	4
4.	**Ethics and Holistic Life**	Harmony in personal and social life: Professional Integrity, Respect & Equality, Building Trusting Relationships. Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all. Understanding Nine universal values in relationships. Understanding harmony in the Family. Harmony in the Family; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family): Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family. Gender Harmony & equity.	5
		Character, Righteousness and Virtues for A Meaningful Life: Self-Realization Through Spiritual texts: Egoless, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance and Gratitude.	4
		Total Number of Lectures	**28**

LIFE SKILLS AND EFFECTIVE COMMUNICATION LAB

Experiment No.	Title of the Module	List of Experiments	CO
1.	Introduction	Tell Me About Yourself & Elevator Pitch	**K161.1**
2.		Personal Effectiveness and Who Am I activity	**K161.1**
3.	Advanced LSRW Skills	Academic Listening	**K161.2**
4.		Reading	**K161.2**
5.		Essay Writing	**K161.2**
6.	Work-Place Skills	Group Discussions-1	**K161.3**
7.		Group Discussions-2	**K161.3**
8.		Technical Presentations-1	**K161.3**
9.		Technical Presentations-2	**K161.3**

10.		Critical Thinking and Creativity	**K161.3**
11.		Handling Interviews	**K161.3**
12.	Ethics and Holistic Life	TED Talk analysis of Social, Health and Cultural analysis	**K161.4**
13.		TED Talk analysis of Social, Health and Cultural analysis	**K161.4**
14.		Self-Realization Through Spiritual texts	**K161.4**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, PBL)
Total	**100**

Project Based Learning: Students, in groups of 4-5, are required to visit Old Age Home/ Underprivileged Children/ NGO/ Cancer Hospital / etc. Spend time with them for 3-4 hours. Apply Life Skills learned in understanding their feeling and help them by providing solution to ease their stress. Document your visit and present in the class.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. Wadkar, Life Skills for Success, Sage Publication Pvt Ltd, 2019
2.	Human Values, A.N. Tripathi, New Age International Pvt Ltd. Publishers New Delhi ,2005
3.	C. Dale, Become an Effective Leader, New Delhi: Amaryllis, 2012
4.	H. R. Wallace et. al, Personality Development, Cengage Learning India Pvt. Ltd; New Delhi, 2006
5.	B. K. Mitra, Personality Development & Soft Skills, Oxford University Press, New Delhi, 2012.
6.	M. G. Frank, D. Matsumoto, H. S. Hwang, Nonverbal Communication: Science and Applications, 2012, 1st Edition, Sage Publications, New York.
7.	W. S. Pfeiffer, Public Speaking, Pearson, Delhi, 2012.
8.	S. Khera, You Can Win, Macmillan Books, New York, 2003.
9.	S. Kumar, P. Lata, Communication Skills, Oxford University Press,1st, Ed. 2011
10.	M. Raman, S. Sharma, Technical Communication: Principles & Practices, 29th Impression, Oxford University Press, New Delhi, 2009

CO-PO-PSO Mapping:

COs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO-CS**
K161.1					2		2	3	3	
K161.2					2		2	3	3	
K161.3					2		2	3	3	
K161.4					2		2	3	3	
Avg					**2.00**		**2.00**	**3.00**	**3.00**	

Multimedia and Animation Workshop (22B28MA111)

Course Description

Course Code	**22B28MA111**	**Semester: Odd**	**Semester I Session 2024-25**

				Month from July 2024 –Dec 2024	
Course Name	**Multimedia and Animation Workshop**				
Credits	**2**		**Contact Hours**	**1-0-2**	
	Coordinator(s)				
	Teacher(s) (Alphabetically)				

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K171.1	recall various tools in modelling.	Remembering (C1)
K171.2	explain Functions of the tools	Understanding (C2)
K171.3	apply give a demo and make students apply and implement functions, give tasks to apply	Applying (C3)
K171.4	apply and implement various operations like traverse, insertion, deletion, etc. on files	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Microsoft Word	Microsoft Word: Creating, editing, saving and printing text documents, Font and paragraph formatting, Simple character formatting, Inserting tables, smart art, page breaks, Using lists and styles, Working with images, Using Spelling and Grammar check, Understanding document properties, Mail Merge	1
2.	Microsoft Excel	Spreadsheet basics, Creating, editing, saving and printing spreadsheets, working with functions & formulas, modifying worksheets with color & auto formats, graphically representing data: Charts & Graphs, speeding data entry: Using Data Forms, analyzing data: Data Menu, Subtotal, Filtering Data, formatting worksheets, Securing & Protecting spreadsheets	2
3.	Microsoft Power Point	Opening, viewing, creating, and printing slides, applying auto layouts, adding custom animation, using slide transitions, graphically representing data: Charts & Graphs, Creating Professional Slide for Presentation	1
4.	Introduction to Image tools	Raster vs. Vector, creating new images, saving files for print, saving files for web/screen, Working with Adobe Bridge, Using the tools, Using the options bar and other panels, Undoing actions in Photoshop, Customizing the workspace, Tools panel overview	2
5.	Basic Photo Corrections	Strategy for retouching, Resolution and image size, Adjusting the color in Camera Raw, Straightening and cropping the image in Photoshop, replacing	2

		colors in an image, adjusting saturation with the Sponge tool, repairing areas with the Clone Stamp tool, Using the Spot Healing Brush tool, using content-aware fill, Applying the Unsharp Mask filter	
6.	Working with Selections	About selecting and selection tools, Using the Quick Selection tool, moving a selected area, manipulating selections, Using the Magic Wand tool, selecting with the lasso tools, rotating a selection, selecting with the Magnetic Lasso tool, cropping an image and erasing within a selection, Refining the edge of a selection,	2
7.	Layer Basics, Masks and Channels	About layers, Using the Layers panel, rearranging layers, applying a gradient to a layer, applying a layer style, Flattening and saving files, working with masks and channels, creating a mask, refining a mask, creating a quick mask, manipulating an image with Puppet Warp, Working with channels	2
8.	Typographic Design and Video tools	About type, creating a clipping mask from type, creating type on a path, Warping point type, Designing paragraphs of type. Video tools: Open Shot; Shortcut; Blender; Movie Maker 10; iMovie; Kapwing; KineMaster, Lightworks etc.	2
		Total Number of Lectures	**14**
Multimedia and Animation Workshop LAB			
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Microsoft Word	Microsoft Word: Creating, editing, saving and printing text documents, Font and paragraph formatting, Simple character formatting, Inserting tables, smart art, page breaks, Using lists and styles, Working with images, Using Spelling and Grammar check, Understanding document properties, Mail Merge	1
2.	Microsoft Excel	Spreadsheet basics, Creating, editing, saving and printing spreadsheets, Working with functions & formulas, Modifying worksheets with color & auto formats, Graphically representing data: Charts & Graphs, Speeding data entry: Using Data Forms, Analyzing data: Data Menu, Subtotal, Filtering Data, Formatting worksheets, Securing & Protecting spreadsheets	2
3.	Microsoft Power Point	Opening, viewing, creating, and printing slides, Applying auto layouts, Adding custom animation, Using slide transitions, Graphically representing data : Charts & Graphs, Creating Professional Slide for Presentation	1
4.	Introduction to Image tools	Raster vs. Vector, Creating new images, Saving files for print, Saving files for web/screen, Working with Adobe Bridge, Using the tools, Using the options bar and other panels, Undoing actions in Photoshop, Customizing the workspace, Tools panel overview	2

5.	Basic Photo Corrections	Strategy for retouching, Resolution and image size, Adjusting the color in Camera Raw, Straightening and cropping the image in Photoshop, Replacing colors in an image, Adjusting saturation with the Sponge tool, Repairing areas with the Clone Stamp tool, Using the Spot Healing Brush tool, Using content-aware fill, Applying the Unsharp Mask filter	2
6.	Working with Selections	About selecting and selection tools, Using the Quick Selection tool, Moving a selected area, Manipulating selections, Using the Magic Wand tool, Selecting with the lasso tools, Rotating a selection, Selecting with the Magnetic Lasso tool , Cropping an image and erasing within a selection ,Refining the edge of a selection,	2
7.	Layer Basics, Masks and Channels	About layers, Using the Layers panel, Rearranging layers, Applying a gradient to a layer, Applying a layer style, Flattening and saving files, Working with masks and channels, Creating a mask, Refining a mask, Creating a quick mask, Manipulating an image with Puppet Warp, Working with channels	2
8.	Typographic Design and Video tools	About type, Creating a clipping mask from type, Creating type on a path, Warping point type, Designing paragraphs of type. Video tools: OpenShot; Shotcut; Blender; Movie Maker 10; iMovie; Kapwing; KineMaster, Lightworks etc	2
		Total number of Labs	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student in a group of 4-5 will apply the concepts of multimedia and utilize multimedia tools to perform various operations on the multimedia application.

Recommended Reading material:

1.	J. Lambert, F. Curtis, Microsoft Office 2019 Step by Step. Microsoft Press, 2018.
2.	L. Foulkes, Learn Microsoft Office 2019. 1st ed. Packt Publishing, 2020. Web. 25 Sept. 2021.
3.	D.W. Beskeen, C. M. Cram, L. Wermers, J. Duffy, and L. Friedrichsen, Illustrated Microsoft Office 365 & Office 2019, 2019.
4.	P. K. Andleigh, K. Thakrar, —Multimedia Systems and Design, PHI, 2003.
5.	D. Hearn, M.P. Baker, —Computer Graphics C Version, Pearson Education, 2003.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K171.1	3			2			1	1	3	2
K171.2	3	1	1	2			1	1	3	2

K171.3	3	1	1	2				1	3	2
K171.4	3	1	1	3	2		1	1	3	3
Avg	**3.00**	**1.00**	**1.00**	**2.25**	**2.00**		**1.00**	**1.00**	**3.00**	**2.25**

Introduction to Digital Technologies (23B66CS114)

Course Description

Course Code	**23B66CS114**	**Semester Odd**	**Semester I Session 2024-25 Month from Jul to Dec 2024**
Course Name	**Introduction to Digital Technologies**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K172.1	understand the concepts of various digital technologies.	Understanding (C2)
K172.2	explore contemporary tools and frameworks for digital technologies.	Understanding (C2)
K172.3	apply digital technologies for a given problem.	Applying (C3)
K172.4	analyze a given problem to choose appropriate digital technology.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Artificial Intelligence and Machine Learning**	Introduction to AI, ML Fundamentals, ML Algorithms, Training and Evaluation, Applications	4
2	**Data Analytics and Big Data**	Introduction, Data Collection, Storage and Management, Tools and Technologies, Data Analysis Techniques, Big Data Technologies and Ecosystem, Applications and Future Trends	4
3.	**Cloud, Fog and Edge Computing**	Introduction, Use Cases and Applications, Real-World Implementations and Case Studies	3
4.	**Internet of Things**	Introduction, Features, Advantages and Disadvantages, IoT Devices, IoT Framework, IoT Applications, IoT Development Kit	3
5.	**Blockchain and Cyber Security**	Introduction to Blockchain Technology, Blockchain Security and Vulnerabilities, Cryptographic Foundations for Blockchain	4

		Security, Integrating Blockchain with Cybersecurity, Future Trends and Challenges	
6.	**Augmented Reality and Virtual Reality, UI, UX**	Introduction to Augmented Reality and Virtual Reality, UI and UX Design for AR and VR, Designing Interactions and Gestures in AR and VR, AR and VR Accessibility and Inclusivity, Design Challenges and Future Trends in AR and VR	3
7.	**Robotic Automation and Smart Cities**	Introduction, Robotic Automation in Smart Cities, Challenges and Opportunities in Smart Cities	4
8.	**Brain Computer Interface**	Introduction, BCI Technologies and Modalities, Signal Processing and Machine Learning for BCI, BCI Applications in Assistive Technology, BCI in Gaming and Virtual Reality	3
		Total number of Lectures	**28**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will solve a real-world application using the digital technologies. They will give a practical demonstration of the problem and its solution which will help their employability into IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Foster Provost and Tom Fawcett. Data Science for Business. O'Reilly Media, Inc, 2013.
2.	Hyatt Saleh. Machine Learning Fundamentals. Packt Publishing, 2018.
3.	Vecchiola, Christian., Selvi, S.Thamarai., Buyya, Rajkumar. Mastering Cloud Computing: Foundations and Applications Programming. Netherlands, Elsevier Science, 2013.
4.	Vijay Madisetti, ArshdeepBahga, İnternet of Things, "A Hands on Approach", University Press, 2015.
5.	A. T. Choudhari, A. S. Ariff, and S. M. R., Blockchain for Enterprise Application Developers. NJ: Wiley, 2020.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K172.1	1								1	1
K172.2	1			2					2	2
K172.3	2		2	3	2		2	2	3	3
K172.4	2	3		3	2		2	2	3	3
Avg	**1.50**	**3.00**	**2.00**	**2.67**	**2.00**		**2.00**	**2.00**	**2.25**	**2.25**

Second Semester

Data Structures (23B21MA111)

Course Description

Course Code	23B21MA111	**Semester:** Even	**Semester** II **Session:** 2024-25 **Month from** Jan - May 2025
Course Name	Data Structures		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K112.1	demonstrate familiarity with major data structures.	Understanding (C2)
K112.2	identify and construct linear data structure.	Applying (C3)
K112.3	apply algorithms of different data-structures in sorting of data, text compression and cryptography.	Applying (C3)
K112.4	examine the concepts of tree-based data structures, hashing and graphs in practical problems.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Algorithm and Data Structures**	**Algorithms:** Definition, Properties, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations. **Data structures:** Introduction, classification of Data Structures, Operations on data structures.	4
2.	**Linked Lists**	Traverse, Insert, Delete, operations on Singly linked lists, Circular linked lists, Doubly linked lists. Selection sort, Bubble sort, Insertion sort, Linear search, Binary search.	7
3.	**Stacks**	Implementation of stacks using Arrays and linked list, PUSH, POP operations, Evaluation of Infix, Postfix and Prefix Expressions.	5

4.	**Queues**	Implementation of Queues using Arrays and linked list, Insertion and deletion operations on Circular queues and Priority queues	5
5.	**Trees**	Array and Linked list Representation of Binary Trees, Properties of Binary Tree, Traversing a Binary Tree, Merge sort, Quick sort.	5
6.	**Binary Search Trees**	Traverse, search, Insert and Delete operations in Binary Search Tree, importance of balancing.	5
7.	**Heaps**	Heap Property, Max Heap, Min Heap, Heap Sort.	3
8.	**Hashing**	One way hashing functions and their properties, hashing as a search structure, hash table, uses of hash tables in text compression and cryptography.	6
9.	**Graphs**	Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation –adjacency matrix.	2
		Total number of lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Students in small groups will be assigned the problem of searching and sorting of data; design algorithms for information retrieval from tree or graph. They will prepare corresponding computer programs.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**E. Horowitz, S. Sahni and D. Mehta,** Fundamentals of Data Structures in C++, 2nd Ed., University Press, 2016.
2.	**S. Sahni,** Data Structures, Algorithms, and Applications in C++, WCB/McGraw-Hill, 2005.
3.	**A. M. Tenenbaum,** Data Structures Using C, Pearson Ed, India, 1990.
4.	**N. Dale,** C++ Plus Data Structures, Jones & Bartlett Learning; 5th Ed. 2011
5.	**A. Drozdek,** Data Structures and Algorithms in C++, 4th Ed., Cengage Learning, 2013.
6.	**G.A.V PAI,** Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1st Edition, Tata McGraw-Hill, 2017.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K112.1	1	1	1	1					1	2
K112.2	2	2	1	1					1	2

K112.3	3	3	3	1	1		2		1	3
K112.4	3	3	3	1	1		2	1	2	3
Avg	**2.25**	**2.25**	**2.00**	**1.00**	**1.00**		**2.00**	**1.00**	**1.25**	**2.50**

Data Structures-LAB (23B25MA111)

Course Description

Course Code	23B25MA111	**Semester:** Even	**Semester** II **Session -** 2024-25 **Month from** Jan - May 2025
Course Name	Data Structures-LAB		
Credits	2	**Contact Hours**	0-0-4
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K137.1	demonstrate familiarity with major algorithms and data structures	Understanding (C2)
K137.2	apply the appropriate linear data and algorithm design method for a specified application.	Applying (C3)
K137.3	apply sorting and searching techniques.	Applying (C3)
K137.4	examine the concepts of nonlinear data structures such as trees, heap and graphs.	Analyzing (C4)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs for the module**
1.	**Introduction to Algorithm and Data Structures**	1. Write an algorithm to find factorial of a number. 2. Write an algorithm to write Fibonacci sequence. 3. Write an algorithm to solve Tower of Hanoi. 4. Write an algorithm to find the largest among three different numbers entered by user.	4
2.	**Linear Data Structures**	5. Implement stack operations using array. 6. Conversion from infix to postfix expression using stack 7. Evaluation of postfix expression. 8. Implement queue operations using array.	4
3.	**Linked Lists**	9. Implement operations on single linked list. 10. Implement operations on double linked list. 11. Implement stack operations using linked list. 12. Implement queue operations using linked list.	4
4.	**Sorting and Searching**	13. Implement selection sort, insertion sort, bubble sort, quick sort, merge sort in C++	2

		14. Implement Linear search and Binary search in C++	
5.	**Non-Linear Data Structures**	15. Implement binary tree using arrays and perform binary traversals. i) Inorder ii) preorder iii) post order 16. Write a C++ program to balance a given tree.	2
		Total number of Labs	**16**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
TA	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: A group of 2 to 3 students will be formed. Each group will have a group leader to develop coordination among the group members. A problem of sorting, searching or data structures characteristics implementation will be given. The group leader will submit a report of findings with output for the same.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**E. Horowitz, S. Sahni and D. Mehta,** Fundamentals of Data Structures in C++, 2nd Ed., University Press, 2016.
2.	**S. Sahni,** Data Structures, Algorithms, and Applications in C++, WCB/McGraw-Hill, 2005.
3.	**A. M. Tenenbaum,** Data Structures Using C, Pearson Ed, India, 1990.
4.	**N. Dale,** C++ Plus Data Structures, Jones & Bartlett Learning; 5th Ed. 2011
5.	**A. Drozdek,** Data Structures and Algorithms in C++, 4th Ed., Cengage Learning, 2013.
6.	**G.A.V PAI,** Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1st Edition, Tata McGraw-Hill, 2017.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K137.1	3	2	2	1			1		1	3
K137.2	3	2	2	1			1		2	3
K137.3	3	3	3	1			1		2	3
K137.4	3	3	3	1	1		2	2	2	3
Avg	**3.00**	**2.50**	**2.50**	**1.00**	**1.00**		**1.25**	**2.00**	**1.75**	**3.00**

Calculus (23B21MA112)

Course Description

Course Code	23B21MA112	**Semester:** Even	**Semester** II **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Calculus**		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	Coordinator(s)	
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to		COGNITIVE LEVELS
K122.1	define the basics of sequence, series and calculus of functions of one or more variables.	Remembering (C1)
K122.2	explain the concepts of sequence, series and calculus of more than one variable.	Understanding (C2)
K122.3	apply the concepts of calculus and differential equations in solving scientific problems.	Applying (C3)
K122.4	analyse the various problems of vector calculus and differential equations.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	**Sequence and Series**	Sequence of real numbers, bounded and monotone sequences, convergence of sequences, Cauchy sequences, sub sequences, Bolzano-Weierstrass theorem. Series of real numbers, comparison test, ratio test, root test, alternating series, absolute and conditional convergence, uniform convergence, power series.	7
2.	**Partial Differentiation**	Concepts of limit and continuity, partial derivatives, Euler's theorem, Chain rule, change of variables, Total differential, Jacobians.	6
3.	**Applications of Partial Differentiation**	Taylor's Theorem, maxima and minima, Lagrange's method of multipliers, estimation of error and approximation of function of two variables.	5
4.	**Multiple Integrals**	Gamma and Beta functions, Double integral, change of order, change of variables, Triple integrals, Dirchilet integrals, applications.	8
5.	**Vector Differential Calculus**	Scalar and Vector point function, Gradient, Directional Derivative, Divergence, Curl and their applications.	4
6.	**Vector Integral Calculus**	Line integral, Surface integral and Volume integral, Applications to work done by the force, Green's, Stoke's and Gauss divergence theorems and their applications.	7
7.	**Differential Equations**	Linear differential equations of second order with constant coefficients, Cauchy-Euler equation.	5
		Total Number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)

Total	**100**
Project based learning: Each student in a group of 4-5 will apply the concepts of differential equations to solve real life practical problems.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**Jain, R. K. & Iyengar, S. R. K.,** Advanced Engineering Mathematics, 5th Ed., Narosa Publishing House, New Delhi, 2019.
2.	**Kreyszig, E.,** Advanced Engineering Mathematics, 10th Edition, John Wiley& Sons, Inc., 2015
3.	**Joel R. Hass, Christopher E. Heil, Maurice D. Weir,** Thomas Calculus, 14th Ed., Pearson Education Asia (Addison Wesley), New Delhi, 2018.
4.	**Goldberg, R. R.,** Methods of Real Analysis, Oxford Publication, 1976.
5.	**Malik S. C.& Arora, S.** Mathematical Analysis, New Age International, 2010.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K122.1	1	2	1						1	
K122.2	1	2	1						1	
K122.3	1	3	1				2	1	2	
K122.4	1	3	1		1		2	1	2	
Avg	**1.00**	**2.50**	**1.00**		**1.00**		**2.00**	**1.00**	**1.50**	

Modern Physics (23B21PH112)

Special Theory of Relativity, Lorentz Transformations and Mass-Energy Equivalence, Wave-Particle Duality, Compton Scattering, Matter Waves, Uncertainty Principle, Schrodinger Equation, Particle in a Box, Potential Barrier Tunnelling, Tunnel diode and its applications, Bonding in solids, Crystal Structure, Miller indices, Bragg's Law and X-ray Diffraction, Introduction to semiconductors, classification of semiconductors, carrier concentration, energy band diagram of p and n types semiconductors, p-n junction diode: band diagram, I-V curve and its application as LED, photodiode and solar cell.

Course Description

Course Code	23B21PH112	**Semester:** EVEN	**Semester: II Session:** 2024-25 **Month from:** Jan-June-2025	
Course Name	Modern Physics			
Credits	3	**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to				**COGNITIVE LEVELS**

K147.1	recall the basic principles of physics related to relativity, quantum mechanics, solid state physics and semiconductors.		Remembering (C1)
K147.2	illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.		Understanding (C2)
K147.3	apply the concepts/principles to solve the problems related to relativity, quantum mechanics, solid state physics and semiconductors.		Applying (C3)
K147.4	analyze and examine the solution of the problems using physical and mathematical concepts involved.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Relativity**	Frame of references, Galilean Transformations, Michelson-Morley experiment, Lorentz transformations, Addition of velocities, Mass variation with velocity, Mass-energy relation.	8
2.	**Quantum Mechanics**	Wave-particle duality, Compton scattering, Matter waves, Heisenberg's uncertainty principle, Schrödinger wave equation and its applications to the free particle in a box (1D+3D), potential barrier and tunnel diode as its application.	16
3.	**Solid State Physics**	Basic ideas of Bonding, Ionic bonding, covalent bonding and Metallic Bonding, Lattice points and space lattice, Basis and crystal structure, Unit cell and Primitive cell, Seven crystal systems and Fourteen, Bravais space lattice, Coordination number, nearest neighbor distance, atomic radius and packing factor in crystal structure, Calculation of lattice constant, Lattice planes and Miller indices, Separation between lattice planes, Derivation and examples, X-ray diffraction, Bragg's law of X- ray diffraction.	10
4.	**Semiconductors**	Introduction to semiconductors, direct and indirect band gap semiconductors, intrinsic and extrinsic semiconductors, carrier concentration, energy band diagram of p and n types semiconductors, p-n junction diode: band diagram, I-V curve and its application as LED, photodiode and solar cell.	6
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35

TA	25 (Quiz, Assignments, Tutorials)
Total	**100**
Project based learning: The students will be given small projects (in groups) on various topics like relativity, Quantum mechanics, solid state physics and semiconductors to explore their applications in modern technology to understand the role of physics. This will help the students to connect the concept studied in the class with their application in technology and will enhance their analytical skills.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Reshnick, Relativity, New Age.
2.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
3.	David J. Griffiths, Introduction to Quantum Mechanics, Second Edition, Pearson.
4.	Ghatak and Lokanathan, Quantum Mechanics, 5th Edition, Macmillan India.
5.	S. O. Pillai, Solid State physics, New Age International (P) Limited.
6.	B. G. Streetman and S. Banerjee, Solid State Electronic Devices, Prentice-Hall India.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K147.1		1		1					2	
K147.2		2		1					2	
K147.3		2		1					1	
K147.4		1		1					1	
Avg		**1.50**		**1.00**					**1.50**	

Environmental Science (23B12BT111)

Course Description

Subject Code	23B12BT111	**Semester:** Even	**Semester:** II **Session:**2024-2025 **Month from:** Jan-May 2025
Subject Name	**Environmental Science**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K156.1	outline diversity of environment, ecosystem resources, resource mismanagement and measures for conservation.	Understanding (C2)

K156.2	explain hazards related to environmental pollution, associated Laws, policies and safe practices		Understanding (C3)
K156.3	apply modern techniques of planning & management, to meet Sustainable Development Goals (SDG)		Applying (C3)
K156.4	select and study regional environmental cases and present the findings		Applying(C4)
Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	The Multidisciplinary nature of environment	Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Case studies.	3
2.	Biodiversity & conservation	Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity, Case studies	3
3.	Natural resources, Energy consumption & conservation	Water, Land, Energy (Renewable, non-renewable, wind, solar, hydro, Biomass) resources, Global Conventions on Energy, Kyoto protocol, Case studies.	8
4.	Pollution, hazardous waste management	Air, Water & Land, pollution, sources & causes, effects, Electronic waste, nuclear hazards, Case studies.	6
5.	Urban planning, Disaster management	Sustainable building, Disaster Management and Contingency Planning, Critical issues concerning Global environment Urbanization, global warming, climate change, acid rain, ozone depletion etc Case studies	4
6	Environmental Policies, Laws, Regulations & ethics	Environmental Policy and laws, Different Acts such as: Environmental Protection Act, Air and Water Acts, Wildlife and Forest Acts), SPCB and CPCB, their roles and responsibilities.	4
7	Field Work/	Explore the current environment related occurrences at national and international level, Study of successful sustainable measures, a know-how of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-Urban/Rural	2

		/Industrial / Agricultural, Study of simple ecosystems.	
		Total number of Lectures	**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid	30
End	40
Teachers Assessment (TA)	30 (Quiz, Assignments, PBL)
Total	**100**

PBL: Visit to a local polluted site-Urban/Rural /Industry/Agricultural, Survey ground situation on specific environmental aspects, and their possible impacts on water, air and land quality, identify risks involved, make a field report and present the findings

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Benny Joseph, Environmental Studies Simplified, 3rd Edition, McGraw Hill Education, India, Published 2nd August, 2017
2.	Erach Bharucha, Textbook of Environmental Studies for UG Courses, 3rd Edition, Orient Black Swan, Published 1st Jan 2013
3.	Issues of the Journal: Down to Earth, Published by Centre for Science and Environment (CSE), Delhi

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K156.1						2		1	2	
K156.2						2		1	2	
K156.3						3	1	1	3	
K156.4						2	3	3	3	
Avg						**2.25**	**2.00**	**1.50**	**2.50**	

Object Oriented Programming using C++ (24B28MA111)

Course Description

Course Code	**24B28MA111**	**Semester:** Even	**Semester:** II **Session** 2024-25 **Month from:** Jan-May 2025
Course Name	**Object Oriented Programming using C++**		
Credits	**3**	**Contact Hours**	**2-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K167.1	explain the fundamental concepts of object-oriented programming.		Understanding (C2)
K167.2	demonstrate C++ code using control structures, data types, operators and object-oriented concepts.		Understanding (C2)
K167.3	construct the classes and objects for solving problems.		Applying (C3)
K167.4	examine the use of C++ concepts such as overloading, polymorphism etc.		Analyzing (C4)
Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	**Introduction to OOPs concepts**	Object oriented programming paradigm, basic concepts of object oriented programming, benefits of object oriented programming, object oriented languages and its applications.	3
2.	**Control Structures**	Data types, type compatibility, variables, operators in C++, implicit conversions, operator overloading, operator precedence.	4
3.	**Classes & Objects, Functions in C++**	Objects, classes, internal representations of objects, the main function, function prototyping, call by reference, return by reference, inline functions, function overloading, friend and virtual functions. specifying a class, member functions,	9
4.	**Constructors & Destructors, Operator Overloading, Inheritance**	Constructors and destructors, defining operator overloading, overloading operators, rules for overloading operators, type conversions.	7
5.	**Pointers, Virtual Functions & Polymorphism,**	Pointers to objects, this pointer, pointer to derived classes, virtual functions, Polymorphism.	5
		Total Number of Lectures	**28**
Object Oriented Programming using C++ - LAB			
Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs**
1.	**Control structures in C++**	Develop C++ programs using conditional structure (if, if-else, nested if), and iterative control structure (do-while, while, for). Implement switch case statement.	4

2.	**Object oriented concepts using C++**	Write output-based C++ programs to implement the concepts of objects, classes, encapsulation, constructors, destructors, function and operator overloading, static and friend functions.	3
3.	**Inheritance using C++**	Write programs in C++ to implement concepts of base class, derived class, method overriding, private and public inheritance, multiple inheritance.	4
4.	**Polymorphism using C++**	Write programs in C++ using virtual functions, pure virtual functions, abstract classes, operator overriding.	3
		Total number of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	**30 (Lab Exam)**
End Semester Examination	**40**
TA	**30** (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on object-oriented programming concepts. The students have to design the class diagram for any real-world application. The students have to implement the mini project using C++language. Project development and its presentation will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc.)

1.	**Balagurusamy E.**, Object-Oriented Programming with C++, TMH, 8th Edition, 2021.
2.	**Lafore R.**, Object-Oriented Programming in C++, Sams Publishing, 5th Edition, 2018.
3.	**Schildt H.**, C++: The Complete Reference, McGraw-Hill Osborne Media, 4th Edition, 2017.
4.	**Stroustrup, B.**, *Programming: Principles and Practice Using C++* (3rd ed.), Addison-Wesley, 2020.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K167.1	2	2	2	2	1		2	1	1	3
K167.2	3	3	3	2	1		1	1	2	3
K167.3	3	3	3	2	1	1	2	1	2	3
K167.4	3	3	3	2	1	1	1	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**	**1.00**	**1.50**	**1.00**	**1.75**	**3.00**

Course Description

Course Code	23B58CS125	**Semester: Even**	**Sem:** II **Session:** 2024-25 **Month from:** Jan-May 2025
Course Name	UNIX Workshop		
Credits	2	**Contact Hours**	1-0-2
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K176.1	recall basic commands of Unix/Linux.	Remembering (C1)
K176.2	demonstrate file handling through different operations.	Understanding (C2)
K176.3	develop shell scripting using Selection, Case & Conditional Statements.	Applying (C3)
K176.4	make use of UNIX administrative controls and solve various problems.	Applying (C3)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs for the module**
1.	The UNIX File System & Basic Commands	1. Understanding the UNIX File System & Execute Basic Commands: To make a study of UNIX Environment and execute basic commands.	1
2.	UNIX Editor & Operations	2. Working with UNIX Editor & understand UNIX processes Operations: To understand working with UNIX Editor and UNIX Processes, Process Utilities.	1
3.	UNIX File Handling & Regular Expressions	3. Working with Directories: To work with Directories such as creation, searching, moving, deleting etc. 4. Working with Files: To work with Files such as creation, searching, moving, deleting etc. 5. Using Regular Expressions for Searching: Using Regular Expressions for Searching in a File or Directory.	3
4.	UNIX Advanced Filters	6. Working with UNIX pipe: Using UNIX pipe to connect two or more commands. 7. Working with UNIX filters: Working with filters to process text in different ways. 8. Working with UNIX advance filters: Working with advance filters, performing Advanced Pattern Matching with Stream-oriented & Non-Interactive Text Editor.	3
5.	UNIX Shell Scripting	9. Working with UNIX Shell: Working with UNIX Shell for basic problems using variables and naming conventions.	2

		10. Performing UNIX Shell Scripting: Performing UNIX Shell Scripting with Conditional Constructs, Looping Statements, Arrays, Functions for problem solving.	
6.	UNIX Administration	11. Performing Document handling through Shell Scripting – Performing Document Handling, Quoting, and Parsing text. 12. Working with UNIX Administration: Working with UNIX Administration, Login Process, Users & Permission and Process Management.	2
		Total number of Labs	**12**

Evaluation Criteria	
Components	**Maximum Marks**
Mid	30
End	40
Day-to-Day	30 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student in a group of 2 will apply the advanced programming concepts in UNIX Environment to solve practical problems.

Text Books	
1.	**Richards Stevens,** Advanced Programming in the UNIX Environment, Pearson Education
2.	**Sumitabha Das,** UNIX Concepts & Applications, 4th Edition, Tata McGraw-Hill
Reference Books	
1.	**Maurice J. Bach,** Design of UNIX Operating System, Prentice-Hall, 1986
2.	**Marc J. Rochkind,** Advanced UNIX Programming, 2nd Edition, Pearson Education, 2004
3.	**Evi Nemeth, Garth Snyder, Trent R. Hein,** Unix and Linux System Administration
4.	**Richards Stevens,** Unix Network Programming, Addison-Wesley Professional, 2004

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K176.1	2	1	1	1			1	1	1	2
K176.2	2	1	2	1			1	1	1	2
K176.3	2	2	2	1			1	1	1	2
K176.4	2	2	2	1			1	1	1	2
Avg	**2.00**	**1.50**	**1.75**	**1.00**			**1.00**	**1.00**	**1.00**	**2.00**

Third Semester

Operating System (23B21MA211)

Course Description

Course Code	**23B21MA211**	**Semester Odd**	**Semester III Session 2024-25 Month from Jul 2024 to Dec 2024**
Course Name	**OPERATING SYSTEM**		
Credits	**4**	**Contact Hours**	3-1 -0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K201.1	define the fundamental components and evolution of operating systems.	Remembering (C1)
K201.2	explain various resource management techniques of operating systems and compare their performances.	Understanding(C2)
K201.3	apply process management concepts, including scheduling and synchronization.	Applying (C3)
K201.4	discuss the working of I/O management and apply in disk scheduling techniques.	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	**Introduction**	Introduction to System Programs & Operating Systems, Evolution of Operating System (mainframe, desktop, multiprocessor, Distributed, Network Operating System, Clustered & Handheld System), Operating system services, Operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling. Types of Operating System: Bare machine, Batch Processing, Real-Time, Multitasking & Multiprogramming, time-sharing system.	10
2	**Process Management**	Concept, Process Control Blocks (PCB), Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms, algorithm evaluation, multiple-processor scheduling, real time scheduling, operations on processes, threads, inter-process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock: Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.	10

3	**Memory Management**	Memory Hierarchy, Concepts of memory management, MFT & MVT, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation. Structure & implementation of the Page table. Concepts of virtual memory, Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation	8
4	**File Management**	concepts, access methods, free space management, allocation methods, directory systems, protection, organization, sharing & implementation issues, Disk & Drum Scheduling, I/0 devices organization, I/0 buffering, I/O Hardware, Kernel I/O subsystem, Transforming I/O request to hardware operations. Device Driver: Path managements, Submodule, Procedure, Scheduler, Handler, Interrupt Service Routine. File system in Linux & Windows	8
5	**Distributed operating system and Security Concept**	Types, Design issues, File system, Remote file access, RPC, RMI, Distributed Shared Memory (DSM), Basic Concept of Parallel Processing &Concurrent Programming, Introduction to distributed operating systems, design goal of distributed OS. Security & threats protection: Security violation through Parameter, Computer Worms & Virus, Security Design Principle, Authentications, Protection Mechanisms. Case study of Unix, Linux & Windows.	6
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: A group of 3 to 4 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to Operating Systems e.g. Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms. Memory Hierarchy, Concepts of memory management. File Management and Distributed operating system and Security Concept. The group leader of each group will submit a report and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. Silberschatz,, P. B. Galvin, and G. Gagne, Operating System Concepts, John Wiley (2018), 10th ed.
2.	W. Stallings, Operating Systems Internals and Design Principles, Prentice Hall (2020), 9th ed.

3.	D.M. Dhamdhere, Operating Systems: A Concept Based Approach, McGraw Hill (2009), 2nd ed
4.	A.S. Tanenbaum "Operating Systems Design and Implementation", Third Edition, Prentice Hall Publications 2015.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K201.1	2	2	2	3	1		1	1	2	3
K201.2	3	3	3	2	1		2	1	2	3
K201.3	3	3	3	2	1		2	1	2	3
K201.4	3	3	3	2	1		2	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.25**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**

Operating System Lab (23B25MA211)

Course Description

Course Code	**23B25MA211**	**Semester Odd**	**Semester III Session 2024-25 Month from Jul 2024 to Dec 2024**	
Course Name	**Operating System Lab**			
Credits	**1**		**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:				**COGNITIVE LEVELS**
K231.1	infer various Unix commands.			Understanding (C2)
K231.2	develop programs to create and manage processes and threads, including Inter-Process Communication.			Applying (C3)
K231.3	make use of resource management techniques.			Applying (C3)
K231.4	analyze memory management policies and page replacement algorithms.			Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**		**No. of Lectures for the module**
1.	**Unix**	Unix Commands-files,-access, open, close, append, read write, pipes, filter, system calls, directory commands, terminal commands, environment commands		3

2.	**Process and Threads**	Process creation/ Inter process communication (IPC) – POSIX thread library, pthread join, threads with global variables, pthread condition variables, parent child processes, zombie process, orphan process	3
3.	**CPU Scheduling**	Resource management tasks like CPU scheduling algorithms, deadlock handling. - FCFS, Priority, Preemptive Priority, Round Robin, SJF, SRJF, MLFQ , Bankers algorithm,	3
4.	**Synchronization**	Synchronization techniques like semaphores, binary semaphore and monitors via different classical test suites, readers writers problem, dining philosophers problem.	3
5.	**Memory Management Policies**	Memory management policies implementation-Best Fit, First fit, Worst Fit page replacement algorithms	2
		Total number of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Viva	20
End Viva	20
TA	60
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a problem related to Operating Systems Concepts e.g. Scheduling criteria Pre-emptive & non Pre-emptive process scheduling, Scheduling algorithms. Memory Hierarchy, Concepts of memory management. File Management and Distributed operating system and Security Concept. The group leader of each group will submit a report and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. Silberschatz, P.B. Galvin and G. Gagne, Operating System Concepts, John Wiley (2018), 10th edition.
2.	W. Stallings, Operating Systems Internals and Design Principles, Prentice Hall (2020), 9th edition.
3.	D.M. Dhamdhere, Operating Systems: A Concept Based Approach, McGraw Hill (2009), 2nd edition.
4.	A. S. Tanenbaum “Operating Systems Design and Implementation”, Third Edition, Prentice Hall Publications 2015.
5.	G. Nutt, “Operating Systems – A modern perspective”, Pearson Education, 2nd Edition 2002.
6.	D. Solomon, M. Russinovich, “Inside Microsoft Windows 2000”, 3rd Edition, Micorosoft Press, 2002.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K231.1	2	2	2	2	1		1	1	2	3
K231.2	3	3	3	2	1		3	1	2	3

K231.3	3	3	3	2	1		3	1	3	3
K231.4	3	3	3	3	1		3	1	3	3
Avg	**2.75**	**2.75**	**2.75**	**2.25**	**1.00**		**2.50**	**1.00**	**2.50**	**3.00**

Computer System Architecture (22B21MA112)

Course Description

Course Code	**22B21MA112**	**Semester Odd**	**Semester III Session 2024-25 Month from Jul 2024 to Dec 2024**
Course Name	**Computer System Architecture**		
Credits	**4**	**Contact Hours**	3-1 -0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K102.1	explain the fundamentals of digital Computer Arithmetic and digital circuits.	Understanding (C2)
K102.2	identify and apply the execution sequence of an instruction through the computer architecture of modern processors.	Applying (C3)
K102.3	analyze RISC and CISC based Computer using Hardwired / Microprogrammed Controller and classify the addressing modes, instructions set.	Analyzing (C4)
K102.4	analyze different levels of memory organizations and apply the knowledge of pipeline and I/O device.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	**Data Representation and Basic Computer Arithmetic**	Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.	04
2	**Basic Computer Organization and Design**	Number systems, complements, fixed and floating-point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers	06
3	**Central Processing Unit**	Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.	08

4	**Memory Organization**	Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture with examples.	07
5	**Input-Output Organization**	Different Levels of Memory organization, Cache memory, Associative memory, mapping and its algorithm	10
6.	**Data Representation and Basic Computer Arithmetic**	Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.	07
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: Project is an integral part of the Subject. Student form group size 3-4, and discuss the project idea with their faculty before finalizing. All projects are based on hardware and hardware components. Programming language is used as per processor/controller. Students develop projects/prototypes to interact with physical environment, control physical object with software. Students learn various processor architecture as well as their programming languages.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt Ltd, Fourth Edition, 2008.
2.	William Stallings, Computer Organization and Architecture–Designing for Performance, Ninth Edition, Pearson Education, 2013.
3.	John L. Hennessy and David A Patterson, Computer Architecture A Quantitative Approach, Morgan Kaufmann / Elsevier, Sixth Edition, 2019
4.	Carl Hamacher, Computer Organization, Fifth edition, McGraw-Hill, 2012.
5.	M.M. Mano, Digital Design, Pearson Education Asia,2018
6.	Nicholas Carter, Schaum's outline of Computer Architecture, Tata McGraw Hill, Special Edition, 2006.
7.	Ramesh Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, Prentice Hall, Sixth Edition, 2013.
8.	Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit

	Extensions: Architecture, Programming, and Interfacing. Pearson Education India, Eighth Edition, 2009.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K102.1	3	3	3	1	1		1	1	2	3
K102.2	3	2	2	1	1		1	1	2	3
K102.3	3	3	3	1	1		3	1	3	3
K102.4	3	3	3	1	1		3	1	3	3
Avg	**3.00**	**2.75**	**2.75**	**1.00**	**1.00**		**2.00**	**1.00**	**2.50**	**3.00**

20B11BMM12: SOCIAL MEDIA AND DIGITAL MARKETING
BBA 2022-25 Batch; BBA Semester III
August to December, 2023
Course Outline

Course Code : **20B11BMM12**

Course Title : **Introduction to Social Media and Digital Marketing**

Course Credit : **3L**

Session Duration : **60 Minutes**

Name of the Faculty : **Dr. Gaurav Katoch/ Dr. Ridhima Bhanot Sharma**

Email ID : **gaurav.katoch@mail.jiit.ac.in**

1. Course Introduction

In this rapidly growing media landscape, social media is an essential tool and fundamental skill in a multitude of industries. The correct amount of hands on practice and social media education can empower students with a competitive edge in their careers. This course will teach marketing students how to create and maintain a social media presence for business on various social media platforms. Students will learn to use social media and content marketing to grow their business and engage with customers.

2. Course Objectives

- Recognising the ability of the social media to increase efficiency in established marketing functions
- Learning how the field of Marketing can benefit from application of social media management.
- Appreciating how organisations can leverage the benefits of social media for maximum benefit
- Embracing bleeding edge business strategies that generate revenue while delivering customer value

3. Course Outcomes

- Understand the role of social media and digital marketing in marketing strategy.
- Analyze the structure of Social Media & Digital Marketing Campaigns
- Evaluate digital consumer behaviour using different analytics tools.

CO-PO and CO-PSO Mapping:

CO Code	COGNITIVE LEVELS		PO1	PO2	PO3	PO4	PO5
JBAC113.1	BTL-2		2	3	2	2	2
JBAC113.2	BTL-4		3	3	3	3	3
JBAC113.3	BTL-5		4	3	3	2	3
Avg.				**3.0**	**3.0**	**3.0**	**3.0**

4. Recommended Text Books

- Seema Gupta,3E,Mc Graw Hill

5. Additional Readings and References

- Social Media Marketing for Dummies by Shiv Singh, John Wiley & Sons Canada, Ltd.
- E-Marketing, Judy Strauss, Adel El-Ansary, Raymond Frost, Pearson, 2008.

6. Evaluation Components:

There will be continuous evaluation spread across the semester. The marks spread are as under:

S. No.	Components	Weightage(%)	Tentative Week
1	T1	20	As per schedule
2	Quiz	10	6-7
3	T2	20	As per schedule
4	Online Certification in Social Media and Digital Marketing Courses	5	10
4	Project	10	8-10
5	T3(End-Term Exam)	35	As per schedule
Total		100	

6.1 Quiz on Social Media and Digital Marketing Tools (10%)

Each student must appear in the quiz component held in one of the classroom sessions after T1.

6.2 T1 & T2 (40%)

T1 & T2 exams will be based on class discussion, lectures, power points and assigned chapters in the textbook. This will be a 'closed book' descriptive and problem solving questions based test on concepts and application. No class notes, textbook or help-sheets should be in your possession or accessed illegally during the test. Any violation will result in disciplinary action.

a. **Online Certification in Social Media and Digital Marketing Courses (5%)**

Students will be asked to acquire certification in HubSpot digital marketing course.

b. **Project Report (10%)**

Groups will be formed. Each group has to choose an organization (a neighbourhood store/NGO/School/ business venture etc). Students need to plan, formulate, apply and measure social media marketing strategies for the selected organization. Students will have to take the consent from the business owner and will have to keep her in the loop and take consent at every stage of planning, formulating and applying social media marketing strategies. The project will be done in four phases, in the first phase identifying and defining objective, in the second phase –customer profiling, third phase will involve creating social media marketing strategies and finally evaluating the strategies will be part of the phase four.

6.5 T3 End-Term Exam (35%)

End-Term Exam will be at the end of the trimester and will cover the entire course. This will also be a 'closed book' test based on conceptual and application based real life questions/ problem(s)/ Case(s). No class notes, textbook or help-sheets should be in your possession or accessed illegally during the test. Any violation will result in disciplinary action.

7. Pedagogy:

The course will involve a good balance of classroom discussion, exercises, experiential activities and real life project work which will generally include a mixture of lectures, exercises, case analysis and live projects. Students will be encouraged to do MOOC courses and acquire certificates.

8. Session Plan

Students are expected to read the chapter from the prescribed book beforehand to make sessions more productive and focused.

No. of sessions	Topics	Readings	Case Studies

1-4	Introduction to Digital marketing	Chapter 1	Jet Blue, Ariel Fashion Shoot
4-8	Display Advertising	Chapter 2	Fall & Rise of Maggie
9-12	Search Engine Advertising	Chapter 3	Lego's Market Segmentation Strategy
13-16	Social Media Marketing	Chapter 4	British Petroleum Runs the social media Gauntlet, ICICI, Tata Docomo
17-20	Meta and LinkedIn Marketing	Chapter 5,6	Mercedes-Benz, H&M
21-24	Mobile Marketing	Chapter 9	Philips AirFryer, Kan Khajura Station
25-28	Search Engine Optimisation	Chapter 10	Barclays Business Banking SEO Campaign
29-33	Video Marketing	Chapter 12	Anything for Jetta
34-38	Online reputation Management	Chapter 14	Who are you with Nikon How Business Pioneer take advantage of Quora Anvil Media uses Linkedin for brand buildings
39-42	Technological Advancements in Digital Marketing	Chapter 15	Cadbury AI ML Campaigns

English Literature (23B21HS211)

Course Description

Course Code	**23B21HS211**	**Semester:** Odd	**Semester:** III **Session:** 2024-25 **Month:** July 2024 - Dec 2024
Course Name	**English Literature**		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above -mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K251.1	outline different genres of literature and aspects of language learning through literature.	Understanding (C2)
K251.2	make use of rhetoric, figurative language, and theoretical concepts in literary texts.	Applying (C3)
K251.3	examine a literary text thematically and stylistically and categorise as a mirror of society.	Analyzing(C4)

K251.4	appraise literature as a learning interface of moral values and ethics of life and society.		Evaluating(C5)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures in the module**
1.	**Introduction to Literature & Genres**	• Literary Genres • Literary Devices • Aspects of Language • Learning Communication Skills through Literature	5
2.	**Poems**	• If: Rudyard Kipling • Ode to Clothes: Pablo Neruda • The Road Not Taken: Robert Frost • Success is Counted Sweetest: Emily Dickinson • Goodbye Party for Miss Pushpa T.S.: Nissim Ezekiel • The Highway Man: Alfred Noyes	7
3.	**Introduction to Theories**	• Psychoanalysis • Structuralism • Reader Response Theory • Freitag's Narrative Techniques	4
4.	**Prose & Short Stories**	• Swami Vivekanand's Chicago Speech • Castaway: Rabindranath Tagore • Monkey's Paw: W.W. Jacob	6
5.	**Plays**	• Andher Naagri Chaupat Raja: Bhartendu Hrishchandra • Refund: Fritz Karinthy	4
6.	**Novel**	• Brave New World: Aldoux Huxley	2
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
(Quiz- 5 Marks, Project Based Learning- 10 Marks, Assignment- 10 Marks)	
Total	**100**

Project Based Learning: The Project will be done in two parts. A group of 4-5 students would be required to take up any text (speech, short story, novel, play or poem, that is not part of syllabus).

Part A: To apply the theories on the text and analyse it thematically and stylistically. Part A could be in the form of a poster presentation or research paper style.

Part B: To submit 1-2 pages report stating the aspects of language, communication skills and ethical standpoints that they have learnt from the text.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	J. E. Eck, *Writing with Sweet Clarity*, 1st Edition, Routledge 2022. https://doi.org/10.4324/9781003167532
2	M.H. Abrams, G. Harpham, *A Glossary of Literary Terms*, 11th Edition, Cengage Learning, 2014.
3	F. Karinthy, *Refund*, e-book @ https://egyankosh.ac.in/bitstream/123456789/27478/1/Unit-4.pdf
4	R. Tagore, *The Castaway* (Rabindrantath Tagore Masterpiece Collection). N. P.: CreateSpace Independent Publishing Platform, 2014.
5	W.W. Jacob, *The Monkey's Paw*, e-book @ https://gutenberg.org/ebooks/12122
6	A. Huxley, *Brave New World* (First Perennial Classics ed.), New York: HarperCollins Publishers, 1998.
7	All poems online: *https://www.poetryfoundation.org/*

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K251.1							1	3		
K251.2							1	3		
K251.3							2		2	
K251.4					2		1			
Avg					**2.00**		**1.25**	**3.00**	**2.00**	

Web Technologies (24B52CS231)

Course Description

Course Code	**24B52CS231**	**Semester Odd**	**Semester III Session 2024-25 Month from Jul 2024 - Dec 2024**
Course Name	**Web Technologies**		
Credits	**3**	**Contact Hours**	**2-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above -mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K262.1	demonstrate the fundamental elements of Web application development using HTML and CSS.	Understanding (C2)
K262.2	explain the web development concepts built on advanced Java scripting.	Understanding (C2)

K262.3	make use of functional aspects of database handling to create database using PHP.	Applying (C3)
K262.4	analyze the integration of MYSQL for database connectivity with web pages.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1	**Review of Essential topics in Web Development**	Introduction to HTML Programming: The Basics (Head, Body, Colors, Attributes), Lists and Links.	**6**
2	**Web development in design of web pages using XML and CSS**	Introduction: XML Basics: XML Structure and Syntax, Document classes and Rules. Other XML Concepts: Scripting XML, XML as Data, Linking with XML. XML with Style: XSL –Style Sheet Basics, XSL basics, XSL style sheets, Cascading style sheet (css).	**6**
3	**Developing dynamic web pages using Java Script**	Data types and variables, functions, methods and events, controlling program flow, JavaScript object model, built-in objects and operators.	**6**
4	**Databases and PHP**	PHP: Starting to script on server side, Arrays, function and forms. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Database Connectivity with PHP, Database Connectivity using MYSQL.	**10**
		Total Number of Lectures	**28**

Web Technology - LAB

Module No.	Title of the Module	List of Experiments	No. of Labs for the module
1	**Review of Essential topics in Web Development**	Introduction to HTML Programming: The Basics (Head, Body, Colors, Attributes), Lists and Links.	**3**

2	**Web development in design of web pages using XML and CSS**	Introduction: XML Basics: XML Structure and Syntax, Document classes and Rules. Other XML Concepts: Scripting XML, XML as Data, Linking with XML. XML with Style: XSL –Style Sheet Basics, XSL basics, XSL style sheets, Cascading style sheet (css).	**3**
3	**Developing dynamic web pages using Java Script**	Data types and variables, functions, methods and events, controlling program flow, JavaScript object model, built-in objects and operators.	**3**
4	**Databases and PHP**	PHP: Starting to script on server side, Arrays, function and forms. Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Database Connectivity with PHP, Database Connectivity using MYSQL.	**5**
		Total number of Labs	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Lab Exam)
End Semester Examination	40
TA	30 (Quiz, Assignments, Tutorials)
Total	100

Project based learning: A group of 4-5 students will develop a web application using any of the web technologies (either single or in combination) covered as part of this course. Students will be required to develop a secure web application having countermeasures implemented against web hacks like XSS, CSRF, injection attacks, DOS attacks etc. Building a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of cyber security will give students hands on experience of working in the area of web technology and cyber security. The knowledge gained will enhance their employability in the IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	V. DeBolt, Integrated HTML and CSS A Smarter, Faster Way to Learn Wiley / Sybex, 2006.
2.	C. Williams, C. Williams Introduction to HTML and CSS, O'Reilly, 2015
3.	HTML A Beginner's Guide, Tata McGraw-Hill Education, 5th edition 2013.

4.	J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007
5.	S. Holzner, PHP: The Complete Reference Paperback, McGraw Hill Education (India), 2008.
6.	R. Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd edition Paperback, O'reilly, 2014.
7.	D. Sklar, A. Trachtenberg, PHP Cookbook: Solutions & Examples for PHP Programmers, 2014.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K262.1	3	3	3	2	1		2	1	2	3
K262.2	2	2	2	2	1		1	1	2	3
K262.3	3	3	3	2	1		3	1	3	3
K262.4	3	3	3	2	1		2	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**2.00**	**1.00**	**2.25**	**3.00**

Fourth Semester

Open Source Programming (24B51CS241)

Course Description

Course Code	**24B51CS241**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024
Course Name	**Open Source Programming**		
Credits	**3**	**Contact Hours**	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above -mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K211.1	define open source software (OSS) and relate the benefits of various OSS models.	Remembering (C1)
K211.2	understand the concept of Python for open source software development	Understanding (C2)
K211.3	develop applications and database using the open source Python language.	Applying (C3)
K211.4	analyze data charts or graphs using open source tools.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	Introduction to open source	What is open source software, what is proprietary software, open source governance models, advantages of OSS, contributing to OSS projects.	3

2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, expression, Python programming continued: conditional statements, functions, strings.	9
3.	Data structure in Python	Array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	9
4.	Python libraries	Introduction to Python libraries: NumPy, case study for the implementation of all libraries.	4
5.	Data storage and retrieval	File processing, reading, writing and appending to files, connectivity of Python with SQL database, querying and retrieving data.	7
6.	Data Visualization	Introduction to Matplotlib, introduction to data visualization, types of charts, steps for creating data visualization.	7
7.	Case Studies: Popular open source software	Study popular open source software, their architecture, development time-line, challenges.	3
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., and Wilson G.,** The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks. Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.,** Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.

Reference Books

3.	**Barry P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey C.**., Coding Club Python: Next Steps Level 2, Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K211.1	3	3	3	2	1		2	1	2	3
K211.2	3	3	3	2	1		2	1	2	3
K211.3	2	2	2	2	1		1	1	2	3

K211.4	3	3	3	2	1		2	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**

Open source Programming Lab (24B55CS242)

Course Description

Course Code	**24B55CS242**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024
Course Name	**Open Source Programming Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above -mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K236.1	define open source software (OSS) and relate the benefits of various OSS models.	Remembering (C1)
K236.2	understand the concept of Python for open source software development	Understanding (C2)
K236.3	develop applications and database using the open source Python language.	Applying (C3)
K236.4	analyze data charts or graphs using open source tools.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to Open Source	Hands on existing open source software.	1
2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, Python interpreter, identifiers and keywords, literals, strings, operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator. Ternary operator, Bit wise operator, Increment or Decrement operator), Expression, conditional statements, functions, strings.	3
3.	Data structure in Python	Programming practice on array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	3
4.	Python libraries	Working on Python libraries: NumPy, case study for the implementation of all libraries	2
5.	Data Storage & Retrieval	File processing, reading, writing, and appending to files, connectivity of Python with SQL database, querying and retrieving data.	2
6.	Data Visualization	Program using Matplotlib, data visualization.	2

7.	Case Studies: Popular Open Source Softwares	Case study on popular open source softwares, their architecture, development time-line, challenges.	1
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., Wilson G.**, The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks, Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.**, Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.
3.	**Barry, P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey, C.**, Coding Club Python: Next Steps Level 2. Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K236.1	3	3	3	2	1		2	1	2	3
K236.2	3	3	3	2	1		2	1	2	3
K236.3	2	2	2	2	1		1	1	2	3
K236.4	3	3	3	2	1		2	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**

Data Base Management System (24B51CS243)

Course Description

Course Code	**24B51CS243**	**Semester: Even**	**Semester IV** **Session** 2024-25 **Month from** Jan-May2025
Course Name	**Data Base Management System**		

Credits	**4**	**Contact Hours**	3-1-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K212.1	recall the abstract structure of database systems and programming languages.	Remembering (C1)
K212.2	explain data models and their properties.	Understanding (C2)
K212.3	apply programming languages on various data models.	Applying (C3)
K212.4	analyze transaction management using various database techniques.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction to Databases**	Introduction to databases, physical level of data storage; Structure of relational databases.	4
2.	**Data Models and database design**	Database design and ER model, entity type, attributes, relation types, notations, constraints, extended ER features, relational model	6
3.	**Structured Query Language (SQL)**	Data definition and manipulation, SQL create, insert, update, delete, select statements, order by, aggregate function, join and nested queries	6
4.	**FDs and Normalization**	Anomalies, data dependencies, closures, 1NF, 2NF, 3NF, BCNF, building normalized databases	5
5.	**Relational Algebra**	Introduction, selection and projection, set operations, renaming, joins, division, operators, grouping	5
6.	**Procedural Language**	PL/SQL: stored procedures, functions, cursors, triggers	6
7.	**Transaction Management**	Transactions, concurrency, recovery, security.	5
8.	**Concurrency & Recovery**	Introduction to databases and transactions, ACID properties, serializability and concurrency control, lock based concurrency control (2PL, Deadlocks), time stamping methods, database recovery management.	5
Total Number of Lectures			**42**

Evaluation Criteria Components	**Maximum Marks**
T1	20

T2	20
End-Term	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Henry F K., Abraham S., Sudurshan, S.,** Database System Concepts, McGraw-Hill, 5th Edition, 2006.
2.	**Elmasri R., Navathe, S.B.,** Fundamentals of Database Systems, Pearson Education, 4th Edition, 2006.
3.	**Ramakrishnan R., Gehrke J.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4.	**Connolly T., Begg C.,** Database Systems-A Practical Approach to Design, Implementation and Management, Addison-Wesley, 3rd Edition, 2002.
5.	**Date C.J. ,** Database Design and Relational Theory: Normal Forms and All That Jazz, 2012.
6.	**Chopra R.,** Database Management System (DBMS): A Practical Approach, 5th Edition, 2016.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K212.1	2	2	2	2	1	1	2	1	2	3
K212.2	2	2	2	2	1		2	1	2	3
K212.3	3	3	3	2	1		1	2	2	3
K212.4	3	3	3	2	1		2	2	2	3
Avg	**2.50**	**2.50**	**2.50**	**2.00**	**1.00**	**1.00**	**1.75**	**1.50**	**2.00**	**3.00**

Data Base Management System-Lab (24B55CS244)

Course Description

Course Code	**24B55CS244**	**Semester: Even**	**Semester IV** **Session** 2024-25 **Month from** Jan-May 2025	
Course Name	**Data Base Management System-Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:				**COGNITIVE LEVELS**

K237.1	define the commands of programming languages.		Remembering (C1)
K237.2	explain tables construction in PL/SQL programming.		Understanding (C2)
K237.3	develop and implement a database schema for a given problem-domain.		Applying (C3)
K237.4	compare data base management techniques for transaction management.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MySQL commands.	MySQL Create, Insert, Update, Delete and Select Statements.	6
2.	SQL	Simple queries, sorting results (ORDER BY Clause), SQL aggregate functions, grouping results (GROUP BY Clause), subqueries, ANY and ALL, multi-table queries, EXISTS and NOT EXISTS, combining result tables (UNION, INTERSECT, EXCEPT), database updates	4
3.	Procedural Language	1. Write PL/SQL program for storing data using procedures. 2. Write PL/SQL program for storing data using stored functions. 3. Write PL/SQL program for storing data using cursors and Triggers.	4
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1. **Korth H.F. , Silberschatz A., Sudarshan S.** Database System Concepts, McGraw-Hill, 7th Edition, 2019.
2. **Elmasri R., Navathe S.B.**, Fundamentals of Database Systems, Pearson Education, 5th Edition, 2015.

Reference Books

3. **Ramakrishnan G.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4. **Connolly T., Begg C.,** Database Systems - A Practical Approach to Design, Implementation and Management, Addison-Wesley, 6rd Edition, 2015.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K237.1	2	2	2	2	1	1	2	1	2	3
K237.2	2	2	2	2	1		2	1	2	3
K237.3	3	3	3	2	1		1	2	2	3
K237.4	3	3	3	2	1		2	2	2	3
Avg	**2.50**	**2.50**	**2.50**	**2.00**	**1.00**	**1.00**	**1.75**	**1.50**	**2.00**	**3.00**

Design and Analysis of Algorithms (24B21MA211)

Course Description

Course Code	**24B21MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024	
Course Name	**Design and Analysis of Algorithms**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K213.1	explain different sorting and searching methods.	Understanding (C2)
K213.2	identify the complexity of different algorithms using asymptotic analysis.	Applying (C3)
K213.3	apply algorithmic principles for solving computational problems.	Applying (C3)
K213.4	analyze an efficient solution to a given problem using appropriate data structure and algorithm design techniques.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Introduction to problem solving approach; asymptotic analysis: growth of functions and solving recurrences; notations- big O, big omega, big theta, little O; empirical analysis of sorting and searching algorithms – merge sort, quick sort, heap sort, radix sort, count sort, linear search, binary search and median search.	6
2.	Divide and Conquer Methods	Fundamentals of divide and conquer (D&C) approach using binary search, quick sort and merge sort; Strassen's matrix multiplication and closest pair, etc.	6
3.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm,	7

		fractional and 0/1 Knapsack; coinage problem, bin packing; job scheduling–shortest job first, Shortest remaining job first, etc., graph coloring; and text compression using Huffman coding and Shannon-Fanon coding, etc.	
4.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem; Hamiltonian cycle detection, travelling salesman problem, network flow.	6
5.	Dynamic Programming	Fundamentals of dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, coinage problem; matrix chain multiplication, longest common subsequence, longest increasing sequence, string editing.	7
6.	String Algorithms	Naive string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, solving string problems using string data structures like tries, suffix tree and suffix array.	7
7.	Tractable and Non- Tractable Problems	Efficiency and tractability, P, NP, NP-complete, NP-hard problems.	3
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on data structures algorithms. The students can opt any real-world application where these algorithms can be applied. The students have to implement the mini project using C/C++/Java language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material:

1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K213.1	3	3	3	2	1		2	1	2	3

K213.2	3	3	3	2	1		2	1	2	3
K213.3	2	2	2	2	1		1	1	2	3
K213.4	3	3	3	2	1		2	1	2	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**

Design and Analysis of Algorithms Lab (24B25MA211)

Course Description

Course Code	**24B25MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024
Course Name	**Design and Analysis of Algorithms Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K238.1	understand various data structures and algorithm design techniques with the help of examples.	Understanding (C2)
K238.2	develop an efficient solution to a given problem using appropriate data structure and algorithm design technique.	Applying (C3)
K238.3	apply and build various algorithms and design techniques to solve given problems.	Applying (C3)
K238.4	evaluate the correctness and complexity of the algorithm for a given problem.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MatLab	Basic operations in MatLab, saving workspaces and files, operations on arrays, matrices, strings and graph objects, native data structures in MatLab, using inbuilt functions and toolboxes, if conditional statements, for and while loops, saving functions,	1
2.	Analysis of algorithms, searching and sorting based problems	Introduction to problem solving approach; asymptotic analysis; solving recurrences; empirical analysis of sorting and searching algorithms – merge sort, Quick sort, heap sort, radix sort, count sort, binary search, and median search,	2
3.	Divide and Conquer Methods	Problems based on divide and conquer (D&C) approach such as binary search, quick sort and merge sort and closest pair, etc.	1
4.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm,	2

		fractional and 0/1 Knapsack, coinage problem, bin packing, job scheduling – shortest job first, shortest remaining job first, etc., graph coloring, and text compression using Hamming coding and Shannon-Fano coding, etc.	
5.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem, Hamiltonian cycle detection, travelling salesman problem, network flow.	2
6.	Dynamic Programming	Fundamentals of Dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, Coinage problem, matrix chain multiplication, longest common subsequence, longest increasing sequence, string editing.	2
7.	String Algorithms	Naïve string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, Tries, suffix tree and suffix array.	2
8.	Problem Spaces and Problem solving by search	Problem Spaces: states, goals and operators, factored representation (factoring state into variables) uninformed search (BFS, DFS, DFS with iterative deepening), heuristics and informed search (hill-climbing, generic best-first, A*).	2
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: Students in a group of 4-5 will be designing an efficient solution to a given problem / case-studies using appropriate data structure and algorithm design technique studies in the course. The students have to implement the mini project using MatLab/C/C++ language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material:

1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K238.1	3	3	3	2	1		2	1	2	3
K238.2	3	3	3	2	2		1	1	1	3
K238.3	3	2	2	2	1		1	1	2	3
K238.4	3	3	3	2	1		2	1	2	3
Avg	**3.00**	**2.75**	**2.75**	**2.00**	**1.25**		**1.50**	**1.00**	**1.75**	**3.00**

Linear Algebra (24B21MA212)

Course Descriptions

Course Code	**24B21MA212**	**Semester: Even**	**Semester** IV **Session** 2023 -2024 **Month from** Jan -May 2024
Course Name	**Linear Algebra**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K226.1	recall basic concepts of algebraic structures and system of linear equations.	Remembering (C1)
K226.2	explain vector space, linear transformation, inner product space and eigenvalue problems.	Understanding (C2)
K226.3	apply the concept of orthogonality and linear transformations in solving the related problems.	Applying (C3)
K226.4	examine the problems related to system of linear equations, diagonalizability of matrices and Gram-Schmidt orthogonalization.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction of modern algebra	Definitions of group, subgroup, cyclic group, normal subgroup, ring, integral domain, field and its examples with simple properties.	8
2.	Vector Spaces	Vector Space, vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct sum and complement.	7
3.	Linear Transformation	Linear transformation and its algebra, its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of linear equations, Determinant, Change of basis, Inverse of a linear transformation.	10

4.	Eigenvalues and Eigenvectors	Eigenvalues and Eigenvectors, Modal matrix and diagonalization, Similarity transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices.	9
5.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 4-5 students will apply the concepts of eigenvalues and eigenvectors, Gram-Schmidt orthogonalization process in solving various related problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Hoffman K., Kunze R.** , Linear Algebra, Prentice Hall of India, Fourth Edition, 2005.
2.	**Strang G.**, Linear Algebra and its Applications, 3rd Ed., 2008.
3.	**Noble B., Daniel J.**, Applied Linear Algebra, Prentice Hall of India, 2000.
4.	**Lipshutz S., Lipsom M. ,** Linear Algebra, 6th Edition, Schaum Series, 2017.
5.	**Krishnamurthy V., Mainra V. P., and Arora J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976.

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K226.1	2	2	1						2	1
K226.2	2	3	2						2	2
K226.3	2	2	2						2	2
K226.4	3	3	2						2	1
Avg	**2.25**	**2.50**	**1.75**						**2.00**	**1.50**

Sustainable Development (24B21HS211)

Course Description

Course Code	**24B21HS211**	**Semester-Even**	**Semester IV Session** 2024-25 **Month from** Jan - May 2025
Course Name	**Sustainable Development**		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K256.1	demonstrate the core principles of sustainable development, including its historical context.		Understanding (C2)
K256.2	apply sustainability tools, frameworks, and metrics in practical scenarios.		Applying (C3)
K256.3	utilize adaptation and mitigation strategies for climate-related challenges using applied knowledge.		Applying (C3)
K256.4	analyze conflicts, governance challenges, and market dynamics related to sustainability.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Sustainable Development	Overview of sustainable development (SD) including its significance, necessity, effects, and ramifications, definition, development of SD perspectives (MDGs AND SDGs) across time, current discussions, 1987 Brundtland Commission and its results, subsequent UN summits (such as the Rio summit) and their results.	6
2.	Dimensions to Sustainable Development	Society, environment, culture, and economy, contemporary issues: natural, political, and socioeconomic imbalances, international, regional, national, and local sustainable development programmes and policies, demands of the current and future generations: political, economic, and environmental.	4
3.	Evaluation, Administration and Reporting Tools for Sustainability	Tools for SD, sustainability measures, including criteria and indicators, the value of both quantitative and qualitative evaluations of sustainability, analytical frameworks in sustainability research, existing measures and constraints, measures for charting and assessing sustainable development use of the metrics in practical situations.	6
4.	Sustainable Development, Energy, Biodiversity, and Climate Change	Climate Change: A threat to Sustainable Development Adaptation to Current and Future Climate Regimes; Agricultural Failure; The Greenhouse Effect; Technology and Lifestyle Changes as Solutions, Climate Change Mitigation, Political and Economic Tools	6
5.	Critical Views on Sustainable Development: The Implications of Resource Management for Sustainable Development	Conflicts arising from the SD idea at the national and international levels, the difficulties SD presents for academic institutions, businesses, and communities, their accountability and possibilities for action, the influence of policies and governance, Market dynamics, regulations, a fresh outlook on sustainability, and sustainable business practises • Sustainable goods and services • Corporate governance • Social responsibility • Encouraging Sustainable Urban Development	6
		Total number of Lectures	**28**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30
End Semester Examination	40
TA	30 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a topic related to Future Perspectives: Developing Sustainable Development. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material:

1.	**Elliott J.**, An Introduction to Sustainable Development, Routledge, London, 4th Ed , 2012.
2.	**Franco I.B. and Tracey J.**, Community Capacity-Building for Sustainable Development: Effectively Striving Towards Achieving Local Community Sustainability Targets, International Journal of Sustainability in Higher Education, Vol. 20 No. 4, pp. 691-725, 2019.
3.	**Rogers P. P., Jalal K.F. , and Boyd, J.A.,** "An Introduction to Sustainable Development, Earthscan publisher, 2012.
4.	**Nhamo G.,Mjimba V.,** Sustainable Development Goals and Institutions of Higher Education. Springer, 2020.
5.	**Bell S. , Morse S.,** Sustainability indicators: measuring the immeasurable, Routledge, 2012.

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K256.1		2		1		3	1			
K256.2		2		3		2	2			
K256.3		3		2		3	2			
K256.4		1		3		2	3			
Avg		**2.00**		**2.25**		**2.50**	**2.00**			

Fifth Semester

Artificial Intelligence and Machine Learning (24B51CS351)

Course Description

Course Code	**24B51CS351**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Course Name	**Artificial Intelligence and Machine Learning**		
Credits	**3**	**Contact Hours**	**3-0-0**
	Coordinator(s)		

Faculty (Names)	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		COGNITIVE LEVELS
K301.1	explain the concepts related to problem solving agents and various uninformed search strategies.	Understanding (C2)
K301.2	utilize probability and first order logic to solve queries.	Applying (C3)
K301.3	apply the clustering and classification techniques for real-world problems.	Applying (C3)
K301.4	demonstrate the different techniques of regressions and dimension reduction.	Analyzing (C4)

Module No.	Title of the Module	List of Experiments	No. of Lectures
1	**Introduction to AI**	Intelligent Agents; Problem solving by Searching; Informed and Uninformed searches; Constraint Satisfaction Problem; Game Trees.	8
2	**Knowledge Representation**	Propositional Logic, First order Logic, Syntax and Semantics), Inference in FOPL.	6
3	**Uncertainty in AI**	Probabilistic reasoning; Bayesian rule, Bayesian network, Maximum likelihood estimation	8
4	**Machine learning**	Supervised; Unsupervised and Semi- Supervised Learning, Decision tree; K- Nearest Neighbor; SVM, K-Means and Hierarchical clustering , Ensemble Learning.	12
5	**Dimension Reduction & Regression**	Normalizing data; feature selection; filtering techniques, PCA, SVD, Linear Regression, Multiple Regression	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Assignment/Quiz, PBL, etc.)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose to design games or solve any real-world problem such as such as disease prediction, stock market prediction etc. problems to apply AI and ML techniques. It helps the students in enhancing their understanding and skills towards artificial intelligence and machine learning knowledge leading towards employability.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books:	
1.	**David l. Poole & Alan k. Mackworthd**, Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017.
2.	**Deepak Khemani,** A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.
Reference Books	
1.	**Stuart Russel and Peter Norvig** , Artificial Intelligence – A modern approach , PHI, 2008.
2.	**Christopher Bishop**, Pattern Recognition and Machine Learning, 2006.
3.	**Tom Mitchell**, Machine Learning, McGraw-Hills, 1997.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K301.1	2	1	2	1			2	2	1	1
K301.2	2	1	1	1			1	2	1	1
K301.3	2	1	2	1			2	2	2	2
K301.4	2	1	2	1			2	2	1	1
Avg	**2.00**	**1.00**	**1.75**	**1.00**			**1.75**	**2.00**	**1.25**	**1.25**

Artificial Intelligence and Machine Learning Lab (24B55CS352)

Course Description

Course Code	**24B55CS352**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Course Name	Artificial Intelligence and Machine Learning Lab		
Credits	**1**	**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K331.1	explain the concepts related to problem solving agents and various uninformed search strategies.	Understanding (C2)
K331.2	implement the clustering and classification techniques.	Applying (C3)
K331.3	utilize AI/ML tools for data feature selection, filtering, training and testing.	Applying (C3)
K331.4	examine the different techniques of regressions.	Analyzing (C4)

Module No.	Title of the Module	List of Experiments	No. of Lab hours
1	**Introduction to Programming in Python**	Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	2
2	**Problem solving**	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS) Informed Search and Exploration (BFS, A*, IDA*, SMA*, IDA*)	2
3	**KNN**	Implement the KNN (K Nearest Neighbours) algorithm in python. Your program should have different functions as follows: 1. Handle Data: Open the dataset from CSV and split into test/train (datasets). A ratio of 67/33 for train/test is a standard ratio used for splitting data. 2. Similarity: Calculate the distance between two data instances. The Euclidean distance is used for calculating the difference. It is defined as the square root of the sum of the squared differences between the two arrays of numbers. Only first 4 attributes are used for calculating the distance. 3. Neighbours: Locate k most similar data instances. 4. Response: Generate a response from a set of data instances. It is a function for getting the majority voted response from a number of neighbors. It devises a predicted response based on those neighbors. 5. Accuracy: Summarize the accuracy of predictions. An easy way to evaluate the accuracy of the model is to calculate a ratio of the total correct predictions out of all predictions made, called the classification accuracy. 6. Main: Take split = 0.67, k=3.	2

4	**Weka Toolkit**	1. Apply the KNN algorithm in Weka tool on the iris dataset. Compare the results of your implemented algorithm with algorithm of Weka tool. 2. Implement the linear Regression. The data will be taken as input from the file. Select the appropriate dataset from the website "https://archive.ics.uci.edu/ml/index.php". Justify the reason why the dataset has been selected. b) Apply the Linear regression in Weka tool on the same dataset. Compare the results of your implemented algorithm with algorithm of Weka tool.	3
5	**Clustering**	Remove the label column of the Parkinson_dataset.csv dataset and implement the following: a) Perform K-Means clustering and Hierarchical clustering. b) Use Manhattan distance c) Use Average merging Strategy in Hierarchical clustering. d) Use three different K values in K-Mean clustering. e) Validate using RMSE and compare both the techniques.	3
6	**Logistic regression and SVM**	Divide the Parkinson_dataset.csv dataset in training and testing dataset randomly and implement the following: a. Classify the disease using Logistic regression and SVM b. Find out the accuracy of classification Model. c. Perform 5-fold cross- validation. d. Compare the result of both techniques using matplotlib.	2
		Total number of Labs	14

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps

the students in enhancing their understanding and skills towards networking and communication issues leading towards employability.
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
Text Books
1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach," PHI, 2017.
2. D. L. Poole and A. K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents," Cambridge University Press, 2017.
References Books
3. M. Lutz, Learning Python: Powerful Object-Oriented Programming, O'Reilly Media, 2013.
4. S. Marsland, Machine Learning: An Algorithmic Perspective, CRC Press, 2015.
5. R. Duda, P. Hart, and D. Stork, Pattern Classification, John Wiley & Sons, 2012

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K331.1	3	3	3	2	2	1	2		2	3
K331.2	3	3	3	2	2	1	2		2	3
K331.3	3	3	3	3	2	2	2		2	3
K331.4	3	3	2	2	2	1	2		2	3
Avg	**3.00**	**3 .00**	**2.75**	**2.25**	**2 .00**	**1.25**	**2.00**		**2.00**	**3.00**

Distributed and Parallel Computing (24B51CS353)

Course Description

Subject Code	**24B51CS353**	**Semester Odd**	**Semester V Session 2024-25 Month Jul to Dec 2024**
Subject Name	**Distributed and Parallel Computing**		
Credits	**3**	**Contact Hours**	**3-0-0**
	Coordinator(s)		

Faculty (Names)	Teacher(s) (Alphabetically)	
COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K302.1	understand Distributed, Parallel and Cloud Computing fundamentals, their characteristics, architectures and performance measures.	Understanding (C2)
K302.2	identify and solve various synchronization related issues in distributed systems, like, clock synchronization, Distributed Mutual exclusion and deadlock handling.	Applying (C3)
K302.3	identify and solve problems related to parallel algorithms, vector processing and superscalar processing.	Applying (C3)
K302.4	analyze agreement protocols, fault tolerance issues and parallel processing algorithms in distributed and parallel computing environments.	Analyzing (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures
1.	**Review of principles, concepts foundation to Distributed Systems.**	Review of Operating Systems principles, Introduction to Distributed Systems.	3
2.	**Synchronization mechanisms**	Resource models, Clock synchronization, Inherent limitations of distributed operating systems. Event ordering. Timestamps. Global state collection mechanisms. Termination Detection, Bully Algorithm. Ring Algorithm.	8
3.	**Mutual Exclusion and Deadlock handling**	Distributed mutual exclusion, Token and non-token based algorithms. Deadlocks handling in Distributed Systems. Comparative performance analysis.	8
4.	**Agreement Protocols**	System Model, Classification, Byzantine Problems and solutions.	2
5.	**Fault tolerance and related Issues**	Fault Tolerance, Reliability and group communications in Distributed Systems.	5
6.	**Introduction to Parallel Computing**	Need of High-Performance Computing, Serial and Parallel Computing, Parallel Architectures, Performance Measures	6
7.	**Pipelining and Processing**	Pipelining, Pipeline performance, Vector processing, superscalar processing, types	8

		of pipeline, Hazards, Scheduling techniques.	
8.	**Introduction to Cloud Computing.**	Introduction to Cloud Computing, Challenges, Cloud Computing architectures, Virtualization in Cloud Computing, Building applications and Infrastructures in the cloud.	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Assignment, PBL, etc)
Total	**100**

Project-Based Learning: A group of a maximum of 2 students is to be formed. Each group shall choose a Distributed Systems, Parallel systems and/or Cloud based project. The project shall be designed and/or modeled either based on Distributed Systems algorithms, Parallel Algorithms and/or using any Cloud Platform, and/or using and distributed/parallel simulation tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance, applicability, tools used and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1	M. Van Steen and A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.
2.	M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw-Hill, 2012.
3.	S.K. Basu, Parallel and Distributed Computing: Architectures and Algorithms, PHI, 2016.
4	G. Ananth, A. Gupta, G. Karypis, V. Kumar, Introduction to Parallel Computing, Second Edition, Addision Wesley, 2003.

Reference Books

1.	Ajay Kshemkalyani and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2	Sukumar Ghosh,. Distributed systems: an algorithmic approach. Chapman and Hall/CRC, 2014.
3.	A. Kulkarni, N.P. Giri, N. Joshi, Bhushan Jadhav, Parallel and Distributed Systems, Wiley Publications, 2016.

4.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier. 2014.
5.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."
6.	R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher. 2014

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K302.1	2	1	1			1	1	1	2	1
K302.2	2	2	1	1	1	2	2	1	2	2
K302.3	2	2	2	2	2	2	2	2	2	2
K302.4	2	2	2	2	2	2	2	2	2	2
Avg	**2 .00**	**1.75**	**1.50**	**1.67**	**1.67**	**1.75**	**1.75**	**1.50**	**2.00**	**1.75**

Computer Networks (24B51CS354)

Course Description

Subject Code	**24B51CS354**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Subject Name	**Computer Networks**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K303.1	illustrate the basics of networking, different network models and underlying technologies of physical layer.	Understanding (C2)
K303.2	experiment with various application layer protocols and switching techniques.	Applying (C3)
K303.3	apply Data Link Layer protocols for communication and error detection and correction.	Applying (C3)
K303.4	inspect various transport layer services and its associated protocols.	Analyzing (C4)
K303.5	evaluate different addressing mechanisms and routing protocols at network layer.	Evaluating (C5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures
1.	**Introduction to Networking**	Introduction: Data communications, networks, network types, Internet history, standards and administration, Network Topologies. Network Models: Protocol layering, TCP/IP protocol suite, The OSI model. Switching: Introduction, circuit switched networks, packet switching.	7
2.	**Application Layer**	Principles of Application-Layer Protocols, World-wide-web and HTTP, FTP, Electronic mail, Domain name system.	6
3.	**Transport Layer**	Introduction to the Transport Layer: Introduction, Transport layer services, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol), UDP/TCP: User datagram protocol, Transmission control protocol, Connection Establishment. Flow Control and Error Control, Congestion Control	8
4.	**Network Layer**	Introduction to the Network Layer: Network layer services, network layer performance, IPv4 addressing (Classful & Classless), Subnetting, Supernetting forwarding of IP packets, Fragmentation. Unicast Routing: Introduction, routing algorithms, unicast routing protocols (Link State & DSDV).	9
5.	**Data Link Layer**	Introduction to the Data Link Layer: Link layer addressing, Data Link Layer Design Issues, Error detection and correction, block coding, cyclic codes, checksum, forward error correction, error correcting codes, error detecting codes, Hamming Codes Media Access Control: Random access, controlled access.	8
6.	**Physical Layer**	Introduction to Physical layer: Data and signals, periodic analog signals, digital signals, transmission impairment, data rate limits, performance Bandwidth Utilization: Multiplexing and Spectrum Spreading: Multiplexing, Spread Spectrum Transmission media: Guided Media, Unguided Media	4
		Total number of Lectures	**42**
Evaluation Criteria **Components**		**Maximum Marks**	

T1	20
T2	20
End Term	35
TA	25 (PBL, Assignments, Attendance, Quiz, etc.)
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems of networking such as congestion control, network traffic analyser etc. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Addison Wesley, 8th edition, 2022
2	Forouzan, B. A., "TCP/IP protocol suite". McGraw-Hill Higher Education, 4th edition, 2017

References Books

1.	Forouzan, A. B., "Data communications & networking", Tata McGraw-Hill Education, 5th edition, 2017
2.	Andrew S. Tanenbaum, "Computer Networks", Prentice-Hall Publishers, 6th edition, 2022
3.	Larry Peterson, Bruce Davie, "Computer Networks a Systems Approach", Morgan Kaufmann, 6th edition, 2021
4.	William Stallings, "Data and Computer Communications", Prentice Hall, 8th edition, 2009

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K303.1	2	1							1	
K303.2	2	1	2	1	1		1	1	2	1
K303.3	2	1	1						1	
K303.4	2	2	2	1	1		1	1	2	1
K303.5	2	2	2	1	1		1	1	2	1
Avg	**2.00**	**1.40**	**1.75**	**1.00**	**1.00**		**1.00**	**1.00**	**1.60**	**1.00**

Computer Networks Lab (24B55CS355)

Course Description

Subject Code	**24B55CS355**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Subject Name	**Computer Networks Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K332.1	classify all the wired/wireless technologies and the basic network building blocks.	Understanding (C2)
K332.2	visualize and analyze the data packets of different TCP/IP layers.	Applying (C3)
K332.3	model a communication network and Estimate its performance.	Applying (C3)
K332.4	create client and server applications using the "Sockets" and the implementation of various protocols at Data link and TCP layer.	Analyzing (C4)
K332.5	design and develop various solution to real-world problems	Creating (C6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**Number of Labs**
1.	**Introduction**	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	2
2.	**Wireshark Simulator**	Practice on WIRESHARK with tcpdump : Application Layer (HTTP,DNS) , Transport Layer (TCP, UDP).	4
3.	**Socket Programming**	Client server programming using TCP and UDP	2
4.	**Network Simulator (NS2)**	Introduction, Topology creation, Visualization, Performance evaluation of TCP &UDP with CBR & FTP traffics, Tracking (AWK Scripting), Plotting through X graph, event driven simulation in NS2	3
5.	**Multicasting/ Broadcasting**	Introduction, Multicast vs Broadcast Routing using ns-2, Estimate the delay caused in the network due to congestions and link breakages	1
6.	**Modeling a realistic Network**	Simulate and compare different error detection and correction and buffer management techniques.	2
		Total No. of Labs	14

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	20

End Term	20
Day to day work	60
Total	**100**

Project based learning: In groups of 2-3, students will choose a networking application or technology to analyze. They will study the OSI model's layers, examining how data flows through each layer and the relevant protocols. The project will also address sustainability challenges like energy efficiency and waste management, highlighting their impact on network design. This hands-on approach helps students understand modern networking applications and issues, enhancing their practical knowledge and employability into related sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet " 6th Edition Pearson Education, 2017.
2.	Andrew S. Tanenbaum," Computer Networks" 4th Edition, 2002

Reference Books

3.	UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	TeerawatIssariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer. 2009
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing, 2015.
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing, 2013.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K332.1	3	2	1		1	2		1	3	1
K332.2	2	1	2	2	1			1	2	2
K332.3	2	1	2	2	1			1	2	2
K332.4	2	2	3	2	1	3		1	2	2
K332.5	3	3	3	3	2	2		2	3	3
Avg	**2.40**	**1.80**	**2.20**	**2.25**	**1.20**	**2.33**		**1.20**	**2.40**	**2.00**

Number Theory and Cryptography (24B21MA311)

Course Description

Course Code	**24B21MA311**	**Semester Odd**	**Semester V Session 2024-25 Month from Jul to Dec 2024**
Course Name	**Number Theory and Cryptography**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
K321.1	define basic concepts related to number theory.	Remembering (C1)
K321.2	explain theory of congruences, Galois field and cryptography.	Understanding (C2)
K321.3	apply theory of congruences and Galois field for solving system of congruences and constructing cryptography algorithms.	Applying (C3))
K321.4	examine security and applications of cryptography algorithms.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	**Divisibility and Primes**	Division algorithm, Greatest common divisor, Euclid's algorithm, gcd as a linear combination of integers, primes, The fundamental theorem of arithmetic, Least common multiple, Prime number theorem (statement only), Testing for Primality.	4
2	**Theory of Congruences**	Definitions and basic properties, Linear Diophantine equations, Residue classes, complete residue systems, reduced residue systems, multiplicative inverse, Linear congruences in one variable, Simultaneous linear congruences, Chinese remainder theorem and its applications, Linear congruences in more than one variable	6
3.	**Primitive Roots and Indices**	Fermat's theorem, Multiplicative function, The Euler's totient function, Euler's theorem, The order of an integer, Primitive roots, Theory of indicies, Solution of non-linear congruences.	7
4.	**Galois field**	Finite fields of the form $GF(p)$, Polynomial arithmetic with coefficients in Z_p, irreducible polynomial, modular polynomial arithmetic, finite fields of the form $GF(2^n)$, irreducible polynomial on $GF(2^8)$, isomorphism among $GF(2^n)$ and $\{0,1\}^n$.	7
5.	**Theory of Cryptography**	Encryption/Decryption, Authentication, Integrity, Digital Signature, key exchange, key management, symmetric cryptography, public key cryptography, AES, DES.	5

6.	**Cryptography Algorithms**	Hill Cipher, RSA cryptosystem, Elgmal Cryptosystem, AES, Cryptanalysis of cryptography algorithms.	7
7.	**Applications of Cryptography**	Diffie-Hellman key exchange, Key Management, Digital Signature Standard.	6
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will be assigned a problem related to the security and applications of cryptography algorithms. Every group will submit a common report.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**David M. Burton**, Elementary Number Theory, 7th Edition, McGraw Hill Education (India) Private Limited, 2017.
2.	**Kenneth Rosen**, Elementary Number Theory and its Applications, 6th Edition, McGraw Hill, 2010.
3.	**William Stallings**, Cryptography and Network Security, Principles and Practices, 8th Edition, Pearson Education Limited, 2023.
4.	**Dirk Hachenberger, Dieter Jungnickel**, Topics in Galois Fields, Springer, 2020.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K321.1	2	2	2	1	1		1	1	2	1
K321.2	2	2	2	1	1		1	1	2	2
K321.3	1	2	2	1	1		1	1	2	1
K321.4	3	2	2	1	1		1	1	2	2
Avg	**2.00**	**2.00**	**2.00**	**1.00**	**1.00**		**1.00**	**1.00**	**2.00**	**1.50**

Summer Internship (24B27MA311)

Course Description

Course Code	**24B27MA311**	**Semester: Odd**	**Semester V Session 2024-25 Month from Jul 2024 to Dec 2024**
Course Name	**Summer Internship**		

Credits	4	Contact Hours	0-0-8
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		COGNITIVE LEVELS
K381.1	relate the knowledge gained from the industrial experience with the subject areas.	Understanding (C2)
K381.2	demonstrate a capacity for critical reasoning and independent learning.	Understanding (C2)
K381.3	utilize the experience gained to enhance their knowledge and skill capabilities for report writing.	Applying (C3)
K381.4	analyse and align their academic and career goals.	Analyzing (C4)

Evaluation Criteria Components	Maximum Marks
Diary	20
Viva	50
Report	30
Total	**100**

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K381.1	3	2	2	3	1		3	1	2	3
K381.2	3	2	2	3	1		3	1	2	3
K381.3	3	2	3	3	2		3	2	2	3
K381.4	3	2	2	3	1		3	2	2	3
Avg	**3.00**	**2.00**	**2.25**	**3.00**	**1.25**		**3.00**	**1.50**	**2.00**	**3.00**

Sixth Semester

Cloud Computing (25B51CS361)

Course Description

Course Code	25B51CS361	Semester: Even	Semester VI Session 2024-25 Month from Jan-May 2025
Course Name	Cloud Computing		
Credits	3	Contact Hours	3-0-0
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:	COGNITIVE LEVELS

K311.1	Explain Cloud Foundational Elements, Deployment & Service Models, Architectures, Virtualization, Protocols, Web services, Security and IOT principles.		Understanding (C2)
K311.2	Apply Cloud principles on various Cloud Technologies, Service Models, Virtualization, Protocols etc.		Applying (C3)
K311.3	Develop Various Cloud based Protocols, Web Services, and Applications.		Applying (C3)
K311.4	Analyze Cloud based Case studies along with Elements of Security and IOT.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Overview of Distributed Computing	Trends in Computing, Distributed Computing, System models for Distributed, Client Server Models, Peer to Peer Models.	3
2.	Introduction to Cloud Computing, Issues and Challenges	Introduction to Cloud Computing, Pay-as-per-use Model, Enabling Technologies, History of Cloud Computing, Deployment Models, Private, Public, Community, Hybrid, Service models, IaaS, PaaS, SaaS. Essential Characteristics, Foundational Elements and Enablers of Cloud Model.	5
3.	Cloud Architecture	Traditional Computing Architecture, Layers of Traditional Architecture, their Pros and Cons. Cloud Computing Architecture, Various Models.	4
4.	Virtualization Techniques	Role of Virtualization in Cloud Computing, Virtualization of resources and related issues. Virtualization Techniques, ISA Level virtualization, Hardware Abstraction level, OS level, Library Level, Application-Level virtualization techniques. Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization, Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization, Introduction to Intel Virtualization Technology (IVT), IA 32 and IA 64 architectures, Challenges in the design of these architectures.	8
5.	Cloud Services and platforms	Current Cloud Services such as Amazon Web Services, Elastic Cloud Compute (EC2), Storage Services, Database Services.	8
6.	Cloud Application Developments	Design considerations for Cloud Applications, Cloud Application Design Methodologies, Service Oriented Architectures, Cloud based Web Services, Containers.	8
7.	Cloud Security	Current state of data in cloud and data security in cloud, Network level security, Access management and control, Authentication in cloud computing.	3
8.	Cloud computing in IoT	Introduction to Cloud Computing in IoT. Applications of Cloud in IoT for Sustainable developments.	3
		Total Number of Lectures	**42**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: A group of a maximum of 2-4 students may be formed. Each group shall choose a Cloud based project. The project shall be based on Emerging Technologies in Cloud Computing, architectures, tools, simulation tools, Cloud Platforms like AWS, Google Cloud. Each group has to do literature survey and submit a report/research paper on the project. The project evaluation shall be done based on the quality, relevance, innovation and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Arshadeep Bagha, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", University Press, 2014.
2.	Sosinsky Barrie, "Cloud Computing Bible", John Wiley & Sons, 2011.
3.	Anthony Velte, Toby Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", McGrawhill, 2010.
4.	R. K. Buyya, J Broberg, Adnrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher, 2011.

Reference Books

1.	Shailendra Singh, "Cloud Computing" Oxford University Press, 2018.
2.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."
3.	Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K311.1	3			3	2	2			2	2
K311.2	3	2	3	3			3	3	3	3
K311.3	3	2	3	3			3	3	3	3
K311.4	3	3	3	3	2	2	3	3	3	3
Avg	**3.00**	**2.33**	**3.00**	**3.00**	**2.00**	**2.00**	**3.00**	**3.00**	**2.75**	**2.75**

Cloud Computing Lab (25B55CS362)

Course Description

Course Code	**25B55CS362**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025	
Course Name	**Cloud Computing Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			

	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K336.1	Explain Cloud Service Models, Deployment models, etc.		Understanding (C2)
K336.2	Develop API and Web Services		Applying (C3)
K336.3	Construct Cloud based applications on available Cloud Platforms.		Applying (C3)
K336.4	Apply and Analyze Cloud based applications by using different services offered by recent Cloud Platforms.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Understand Cloud Architectures, Models, Service Models	Different Cloud Services offered by various Service Providers	**2**
2.	Development of Web Service Applications	Demonstration of Web services and API with simple web service implementations. Development of Web service applications by using various web-based tools, like REST, JSON, etc.	6
3.	Development of Cloud and Web Services based application on Cloud Platforms	Develop Cloud based applications and on Cloud Platforms Like Amazon Web Services (AWS)	6
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (D2D: 40 marks, PBL: 20 marks)
Total	**100**

Project based learning Project Based Learning: A group of maximum 2-4 students are formed. Each group chooses a Cloud and Web Services based project. The project shall be designed and/or modeled based on any Cloud and Web Services based Platform like AWS, RESTful Services, WSDL or any Cloud or Web Services based tools. The project shall function and run as per its objective. Live demonstration of the project shall be shown. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Anthony Velte, Toby Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", McGrawhill, 2010.
2.	David Clinton, "Learn Amazon Web Services in a Month of Lunches", Manning, 2017.
3.	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly publication, January 2011.

4.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", Universities Press, 2014.
Reference Books/Resources:	
1.	Wilkins, Mark, "Learning Amazon Web Services (AWS): a Hands-on Guide to the Fundamentals of AWS cloud", Addison-Wesley Professional, 2019.
2.	B. Jin, S. Sahni, and A. Shevat, "Designing Web APIs: Building APIs that developers love". O'Reilly Media, 2018.
3.	M. Grinberg," Flask Web Development: Developing Web Applications with Python", O'Reilly Media, 2018.
4.	Christopher M. Moyer, "Building Applications in the Cloud: Concepts, Patterns and Projects", Pearson Education India, 2011.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS
K336.1	3			3	2	2			2	2
K336.2	3	2	3	3			3	3	3	3
K336.3	3	2	3	3			3	3	3	3
K336.4	3	3	3	3	2	2	3	3	3	3
Avg	**3.00**	**2.33**	**3.00**	**3.00**	**2.00**	**2.00**	**3.00**	**3.00**	**2.75**	**2.75**

Fundamentals of Soft Computing (24B21MA313)

Course Description

Course Code	**24B21MA313**	**Semester: Even**	**Semester VI** **Session** 2024-25 **Month from** Jan-May2025	
Course Name	**Fundamentals of Soft Computing**			
Credits	**4**	**Contact Hours**	3-1-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K312.1	explain the basic concepts of soft computing, fuzzy logic, optimization problems and artificial neural networks.	Understanding (C2)
K312.2	solve fuzzy systems and single objective optimization problems.	Applying (C3)
K312.3	make use of evolutionary algorithms to solve multi-objective optimization problems.	Applying (C3)
K312.4	analyze soft computing techniques to solve related problems.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**

1.	Introduction of Soft Computing	Overview of Soft Computing, Difference between Soft and Hard computing. Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.	3
2.	Fuzzy Logic	Introduction to fuzzy logic, membership functions, Operations on Fuzzy Sets, Fuzzy relations and rules, Implications	6
3.	Fuzzy Systems	Fuzzy Inference, Defuzzification techniques, Fuzzy logic controllers, Applications of fuzzy logic.	6
4.	Optimization Problems	Optimization Problems, Metaheuristic techniques, Concept of Genetic Algorithm, GA Strategies	5
5.	Genetic Algorithm	GA operators: Encoding, Selection, Crossover, Mutation, Single Objective optimization problems using GA.	8
6.	Multi-Objective Optimization Problem	Concept of MOOPs, Multi-Objective Evolutionary Algorithms, Pareto based approaches, Some applications with MOEAs.	8
7.	Artificial Neural Networks	Biological Neurons and its working, Introduction to ANN, ANN architecture, ANN training.	6
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will collect literature on soft computing techniques. To make the subject application based, the students analyze the soft computing techniques to solve real life problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1. **T.J. Ross,** Fuzzy Logic with Engineering Applications, John Wiley & Sons, 2010.

2.	**D. E. Goldberg,** Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2002.
3.	**R.L. Haupt, S.E. Haupt,** Practical Genetic Algorithms, John Willey & Sons, 2002.
4.	**S. Rajasekaran, G. A. Vijayalakshmi Pai**, Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications, Prentice Hall of India, 2007.
5.	**S. Haykin**, Neural Networks and Learning Machines, (3rd Edn.), PHI Learning, 2011.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K312.1	1	2	1		1				1	1
K312.2	2	3	2		2				2	2
K312.3	2	3	2		2				2	2
K312.4	3	3	3	1	3	1	2	1	2	3
Avg	**2.00**	**2.75**	**2.00**	**1.00**	**2.00**	**1.00**	**2.00**	**1.00**	**1.75**	**2.00**

Java Programming (25B51CS363)

Course Description

Course Code	**25B51CS363**	**Semester: Even**		**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025	
Course Name	**Java Programming**				
Credits	**3**		**Contact Hours**	3-0-0	
	Coordinator(s)				
	Teacher(s) (Alphabetically)				

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K313.1	explain basic concepts of Object-Oriented Programming.	Understanding (C2)
K313.2	develop basic Java programs using Java constructs – loops, switch-case and arrays.	Applying (C3)
K313.3	develop GUI based application programs.	Applying (C3)
K313.4	examine java programs using exception handling, multi-threading and Java collection framework.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	Introduction to Java	Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types,	6

		Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods)	
2.	Arrays, Strings and I/O	Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.	5
3.	Object-Oriented Programming Overview	Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.	5
4.	Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata	Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	8
5.	Exception Handling, Threading, Networking and Database Connectivity	Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.	10
6.	Applets and Event Handling	Java Applets: Introduction to Applets. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls.	**8**
		Total Number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using OOPS concepts. Further they will be able to explore various collections and APIs. The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, GUI, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1, 10th Edition,Printice Hall.2016
2.	James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3.	Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition, Printice Hall. 2013
4.	Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.

Reference Books

1.	Schildt, H. (2021). Java: The Complete Reference, Twelfth Edition. United States: McGraw Hill LLC.
2.	E. Balaguruswamy, "Programming with Java", 7th Edition, McGraw Hill.2023.
3.	Joshua Bloch, "Effective Java" 3rd Edition, Publisher: Addison-Wesley, 2016.
4.	John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.
5.	Kathy Sierra, Bert Bates, "Head First Java", Orielly Media Inc. 3rd Edition, 2022.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K313.1	2	2	2	1	1	1	2	1	1	2
K313.2	1	2	2	1	1	1	1	1	1	2
K313.3	2	2	2	1	1	1	2	1	1	2
K313.4	3	2	3	1	1	1	3	2	2	3
Avg	**2.00**	**2.00**	**2.00**	**1.00**	**1.00**	**1.00**	**2.00**	**1.00**	**1.00**	**2.00**

Java Programming-Lab (25B55CS364)

Course Description

Course Code	**25B55CS364**	**Semester: Even**	**Semester** VI **Session** 2024-25 **Month from** Jan-May 2025
Course Name	**Java Programming-Lab**		
Credits	**1**	**Contact Hours**	0-0-2
	Coordinator(s)		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K337.1	explain basics of Java programming.	Understanding (C2)
K337.2	apply concepts of object oriented programming in Java.	Applying (C3)
K337.3	develop GUI based application programs.	Applying (C3)
K337.4	examine Java programs using Exception Handling, Multithreading and Java collection framework.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to basic Java Programming	Data types, variable, arrays, expressions, operators, and Control flow (conditional statements, loop, etc), Objects and classes.	3
2.	Application of OOPs Concept	Inheritance, use of keywords such as Final, Static, etc. with variable, methods and classes. Abstract classes, Static classes, Inner classes, Packages, Wrapper classes, Interfaces, This, Super, Access control, Abstract class, class constructors and method overloading	4
3.	Exception Handling and Multithreading	Exception handling (try, catch, throw, throws, and finally), Simple thread program, Thread synchronization	3
4.	Java Collection Framework	Collection Overview, List, Map (hash Code& Equals), Set, Queue & other collections, Stream API to process collections of objects	2
5.	Applets and Event Handling	Java Applets: Introduction to Applets. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls.	2
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using OOPS concepts. Further they will be able to

explore various collections and APIs. The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, GUI, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) **Text Books**	
1.	Schildt, H. (2021). Java: The Complete Reference, Twelfth Edition. United States: McGraw Hill LLC.
2.	E. Balaguruswamy, "Programming with Java", 7th Edition, McGraw Hill.2023.
3.	Horstmann, C. S. (2021). Core Java: Fundamentals, Volume 1. United Kingdom: Pearson.
4.	Curry, C. (2020). Object-Oriented Programming with Java. United States: Addison-Wesley Professional.
5.	Loy, M., Niemeyer, P., Leuck, D. (2020). Learning Java: An Introduction to Real-World Programming with Java. United States: O'Reilly Media.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K337.1	3	2	2	1			1	1	2	3
K337.2	3	2	3	2			2	1	2	3
K337.3	3	3	3	2			2	1	2	3
K337.4	3	2	3	3			3	2	3	3
Avg	3.00	2.00	3.00	2.00			2.00	1.00	2.00	3.00

Software Engineering (25B51CS365)

Course Description

Course Code	**25B51CS365**	**Semester: Even**	**Semester VI Session 2024-25** **Month from** Jan-May 2025	
Course Name	**Software Engineering**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			
COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:				**COGNITIVE LEVELS**
K314.1	explain software engineering principles and software process models for project development and develop software requirement specification.			Understanding (C2)
K314.2	apply UML modeling for software design from software requirements specification.			Applying (C3)
K314.3	apply testing principles, develop and implement various manual and automated testing procedures, formal methods.			Applying (C3)

K314.4	examine software in terms of general software quality attributes and possible trade-offs presented within the given problem.		Analyzing (C4)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction to Software Engineering**	Introduction to software engineering Principles, Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary-Prototype and Spiral models, Agile Models (tools study). Project planning, COCOMO Model, Project Scheduling: network diagram, Gant Chart, CPM and PERT.	7
2.	**Requirement Engineering**	Types of requirement, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	4
3.	**Software Design**	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	7
4.	**Software Construction**	Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization. Design pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming.	8
5.	**Software Metrics**	Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric.	7
6.	**Software Testing**	White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods**.**	9
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4. The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills.

Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.	
Recommended Reading material:	
1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Seventh Edition, TMH, 2010.
2.	Ian Sommerville, "Software Engineering", Ninth Edition, Addison-Wesley, 2011.
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, 2005
4.	Richard Thayer, "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press, 1997.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press, 2003.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third edition, Springer Press, 2005.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K314.1	3	2	1	1	1			3	1	2
K314.2		3	3	2			3		1	3
K314.3		2	3	2	1				1	3
K314.4	1	1		1					1	3
Avg	**2.00**	**2.00**	**2.25**	**1.50**	**1.00**		**3.00**	**3.00**	**1.00**	**2.75**

Software Engineering Lab (25B55CS366)

Course Description

Course Code	**25B55CS366**	**Semester: Even**	**Semester VI Session 2024-25** **Month from** Jan-May 2025	
Course Name	**Software Engineering Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:			**COGNITIVE LEVELS**
K338.1	identify the software requirements and prepare SRS documents.		Understanding (C2)
K338.2	design the software model for the given project.		Applying (C3)
K338.3	test the quality of the project using the testing principles.		Analyzing (C4)
K338.4	evaluate the software metrics for the developed project.		Evaluating(C5)
Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	**Problem Analysis and Project Planning**	Identify a real world problem, Determine its project scope, Objectives and Infrastructure.	1

2.	**Software Requirement Analysis**	Describe the individual Phases/modules of the project and Identify deliverables. Preform feasibility study. Identify functional and non-functional requirements. Prepare SRS of the project planned.	2
3.	**Software design modelling**	Develop use case diagrams activity diagrams, class diagrams, sequence diagrams and add interface to class diagrams.	4
4.	**Develop prototype**	Develop of protype of project proposed	2
5.	**Testing**	Test the prototype for black box white box testing	3
6.	**Evaluate the software**	Assess the software on different software metrics	2
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60 (Quiz, Assignments, PBL)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4. The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

Recommended Reading material:

1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Seventh Edition, TMH, 2010.
2.	KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers, Second Edition, 2005.
3.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third edition, Springer Press, 2005.
4.	David Solomon and Mark Russinovich," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press, 2000.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K338.1	1	3		2	1		2	3	1	2
K338.2	2	2	3	3			2		1	1
K338.3	2	1	2	3			2		1	1
K338.4	2						2		2	3
Avg	**1.75**	**2.00**	**2.50**	**2.67**	**1.00**		**2.00**	**3.00**	**1.25**	**1.75**

Operations Research (24B21MA312)

Course Descriptions

Course Code	**24B21MA312**	**Semester: Even**	**Semester** VI **Session** 2024 -2025 **Month from** Jan -May 2025
Course Name	**Operations Research**		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
K326.1	explain fundamentals of linear programming problem and primal-dual relationship.	Understanding (C2)
K326.2	apply different methods to solve linear programming problems.	Applying (C3)
K326.3	solve transportation and assignment models.	Applying (C3)
K326.4	analyze the problems related to game theory.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Linear Programming Problems (LPP)-I	Introduction, Applications in various fields of Operations Research, Formulation of LPP., Convex Sets, Graphical Method, Fundamental Theorem of LPP.	6
2.	Linear Programming Problems (LPP)-II	Basic Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality	Primal-Dual Relationship, Duality, Weak and strong duality theorems, Dual Simplex Method.	6
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	8
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems, Unbalanced Assignment Problems.	6
6.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and m×n Games, Solution of games using LPP.	8
		Total Number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 4-5 will collect literature on transportation and assignment problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO
K326.1	2	2	1				1		1	1
K326.2	2	3	2				2		1	2
K326.3	2	3	2				2	1	1	2
K326.4	3	3	2				2		1	1
Avg.	**2.25**	**2.75**	**1.75**				**1.75**	**1.00**	**1.00**	**1.50**